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JUNE 1960

Heating Piping & Air Conditioning

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. . . for Consulting Engineers • Mechanical (Heating, Piping, and Air Conditioning) Contractors • Engineers with Plants and Big Buildings

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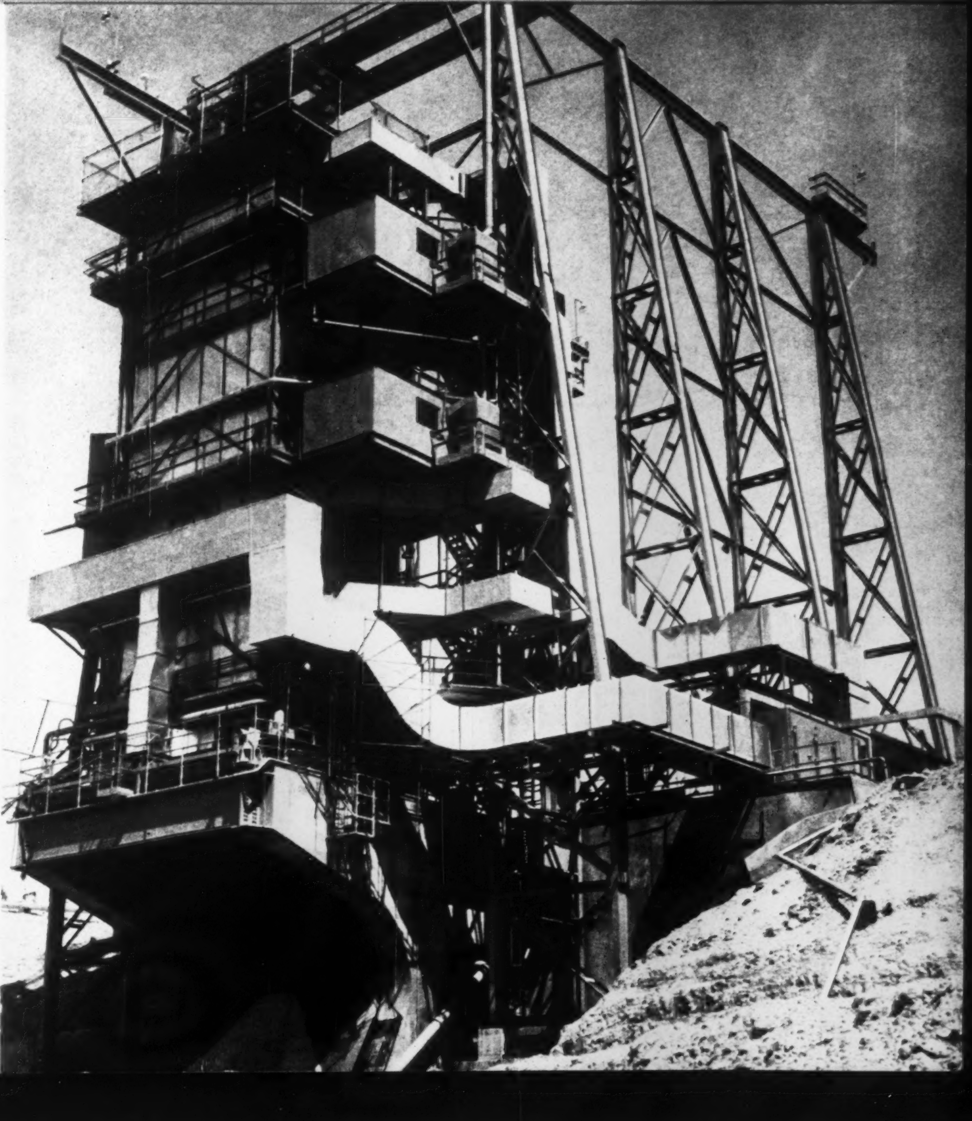

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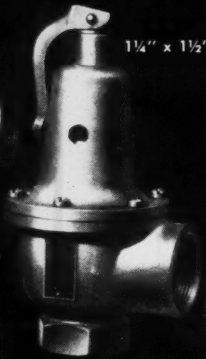
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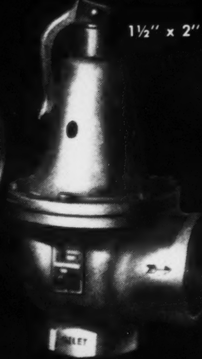
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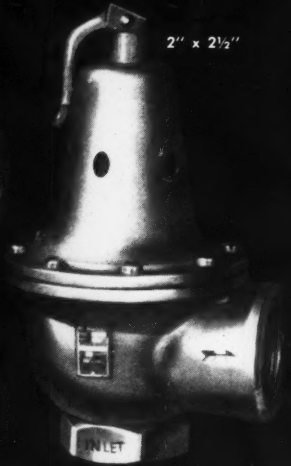
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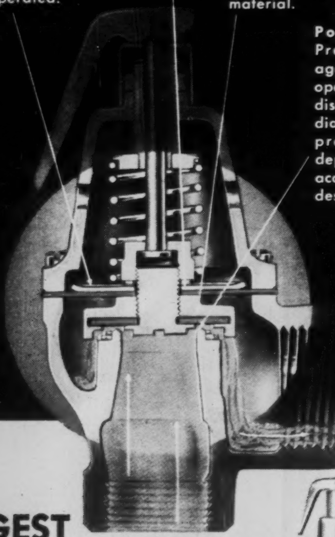

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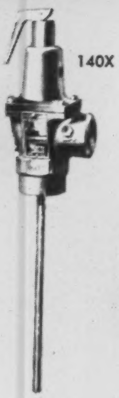
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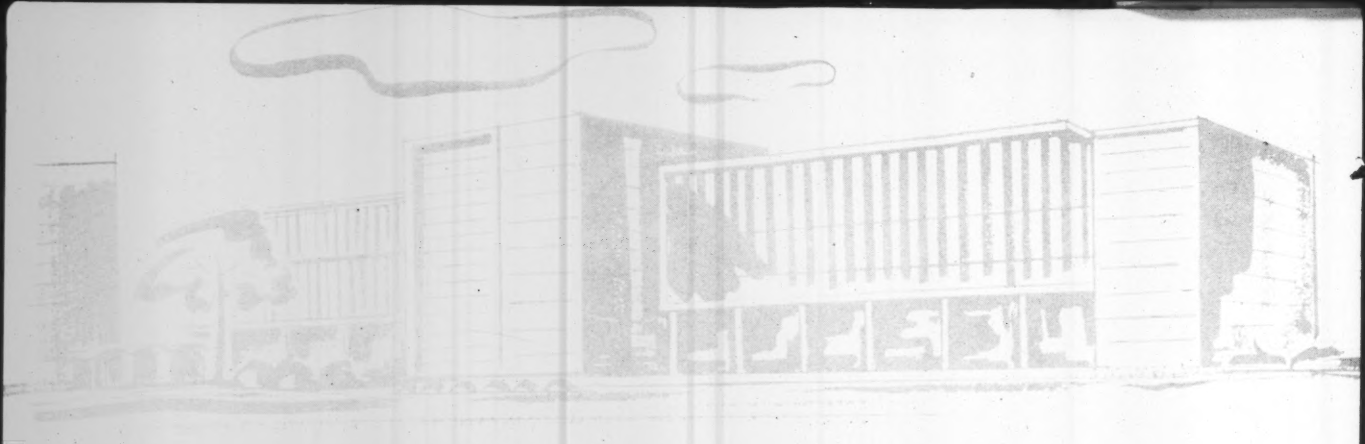

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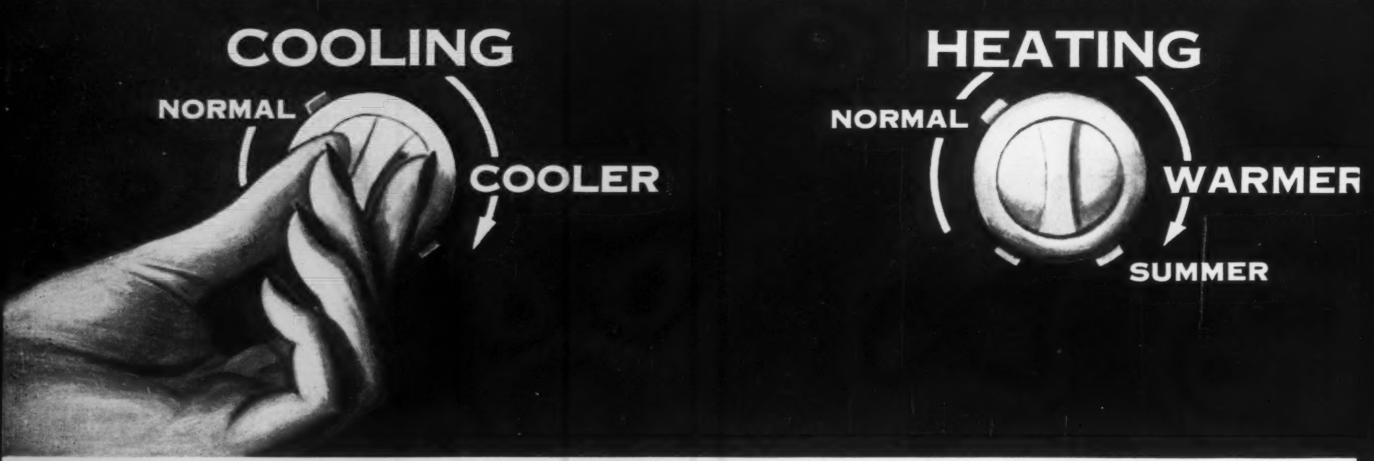

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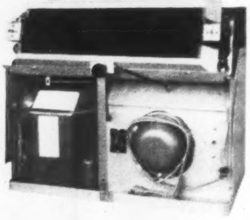

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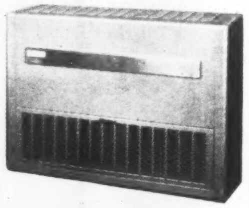

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Heating, Piping & Air Conditioning

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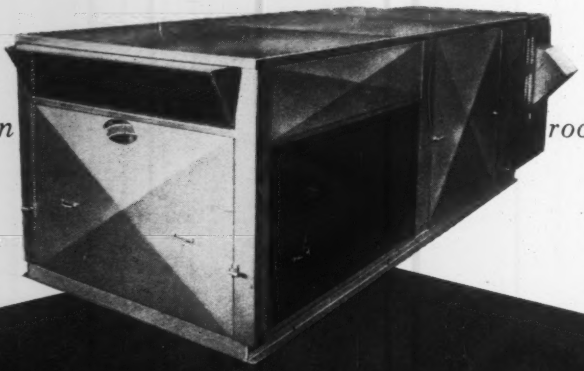

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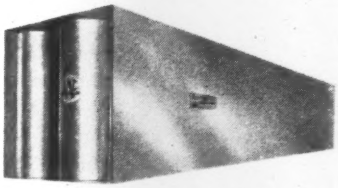

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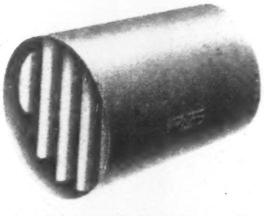

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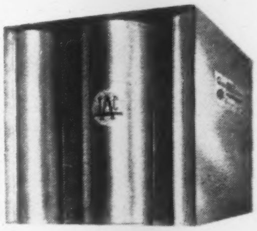

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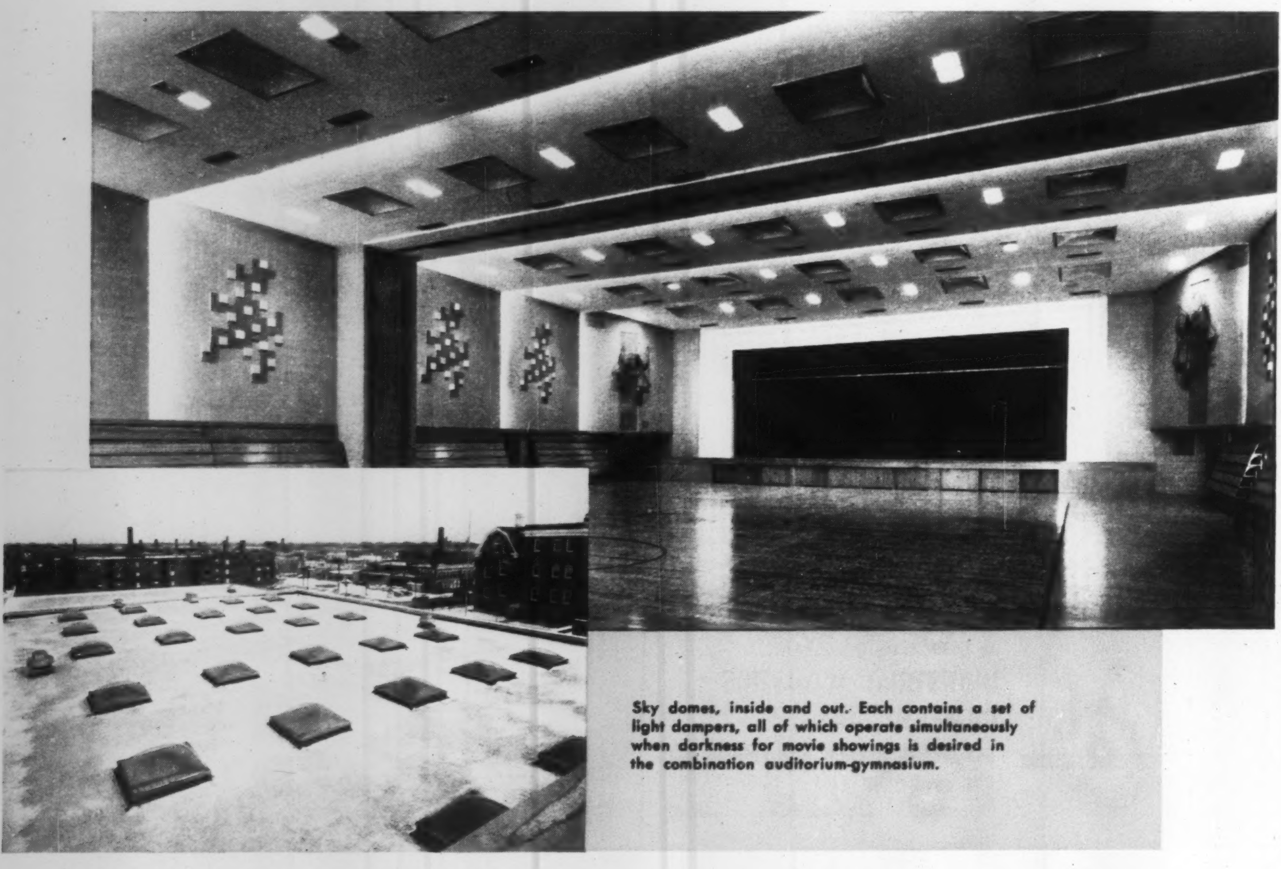
Imaginative Engineering Puts to Work on *DAYLIGHT*

Mike Best and Ed Kralovec, mechanical engineers on the Madonna school, shown discussing job details with two of their colleagues.

Kralovec & Best, consulting engineers, went one step further in their heat and ventilation design for the new Madonna High School, Chicago — they applied pneumatic control to skylight louvers.

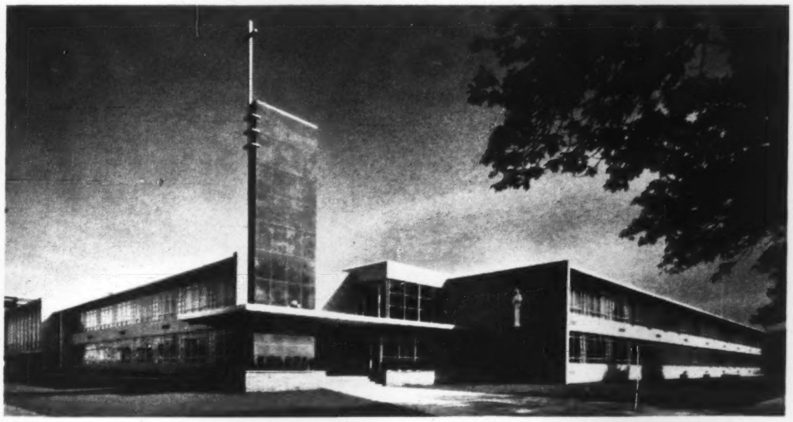
To meet the lighting requirements of the combination auditorium-gymnasium, architect C. I. Krajewski used a system of sky domes equipped with adjustable light dampers. How to control the dampers quickly and efficiently for change-over from plenty of daylight for gym activities to total blackout for movies, etc., was the problem presented to the consulting engineer.

Kralovec & Best's solution was — twenty-nine 4-inch powerstroke piston damper motors — one for each of



Sky domes, inside and out. Each contains a set of light dampers, all of which operate simultaneously when darkness for movie showings is desired in the combination auditorium-gymnasium.

Powers Pneumatic Control



MADONNA HIGH SCHOOL
Chicago, Ill.
Architect: C. I. Krajewski, Chicago
Consulting Engineers:
Kralovec & Best
Chicago
Heating Contractor:
Windsor Heating Co.
Chicago

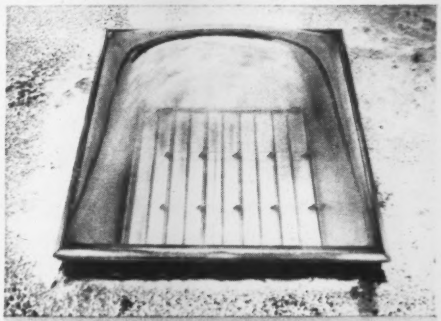
the sky dome louvers on the roof — energized instantly from a single Powers pneumatic selector switch in the projection room. Turning the switch activates air pressure at 15 psi. through a Powers Series 500 Pilot Valve to the motors to close the light louvers. When the switch is turned off, pressure is released . . . and the louvers swing open to admit light.

Pneumatic control of daylight in Madonna school is fast, easy and quiet — a definite convenience for the projectionist or instructors, an operational bargain for the school, maintenance-wise.

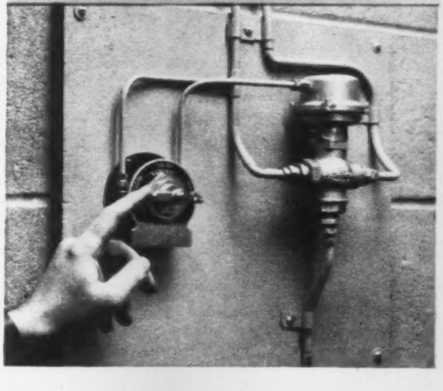
The complete heating system, as specified by Kralovec & Best, includes two hot water converters controlled at fixed temperatures. Individual classrooms are heated and ventilated by unit ventilators, controlled on the standard day-night cycle. Corridors, rest rooms, storage and locker rooms employ direct radiation controlled by Powers Day-Night room thermostats. For extra safety and comfort, hot water to all showers is controlled by means of a Powers Hydroguard Thermostatic Shower Control.

Here, then, is how imaginative engineering applied to pneumatic control can have unusual — but practical — results in an efficient, low cost system.

Write for the latest Powers Catalog of pneumatic controls for schools.



A single pneumatic selector switch in the projection room actuates 29 sets of light louvers through 29 individual powerstroke motors.



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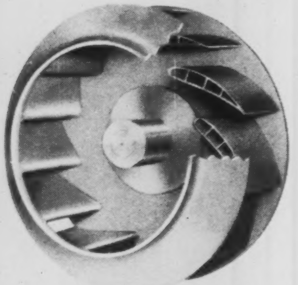

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0329

LETTER FROM THE EDITOR

June 1960

Dear Reader:

With the increasing interest and importance of missiles and rockets, I am sure you will find Herbert Christman's discussion of simulating weather conditions for testing the Thor IRBM on pages 123 through 127 to be very informative. He explains how this world's largest environmental test chamber for rockets puts the Thor through actual flight conditions with the missile never leaving the launching pad. The chamber provides an inside temperature controllable between −35 and +165 F, regardless of the outside weather. The engineering design and planning behind this large facility reflects the need for all of us to keep abreast of the latest methods of determining transient heat flow, understanding the operation of electronic control circuits, evaluation of many operational problems, and others.

To accommodate wide weather fluctuations, a new type of return air heating system has been devised by John D. Aungst of the consulting engineering firm of Ralph R. Stefano. Mr. Aungst explains the principles of this new system in his article on pages 128 through 131. The system mixes superheated return air with the maximum amount of outdoor air that can be admitted in order to maintain the desired indoor temperature. Mr. Aungst shows how discharge temperatures and coil loads vary for a typical installation, and he also discusses three applications of this system in Alaska where the outdoor temperatures may change as much as 100 F in one 24 hour period.

The problem of supplying makeup air for industrial plant exhaust requirements is always one that receives close attention. How Caterpillar Tractor does this without adding to the heating cost is explained by H. P. Kaulfuss in his article on pages 132 through 135. He explains how this makeup air has been introduced in four different applications without heating it. One of the principles that he suggests is to admit the makeup air in such a way that it does not strike the personnel so as to cause drafts.

One of the many interesting subjects discussed last month at the annual convention of the Mechanical Contractors Association of America was a new technique for welding carbon steel pipe. Howard E. Cary presented the information at the pipe welding panel, and the report of this session is on pages 136 to 138. This method of using carbon dioxide gas shielded welding for carbon steel pipe has several advantages that warrant investigation.

What's an acceptable method of cooling a large cooperative apartment building? Louis H. V. Smith, consulting engineer, decided that individual air cooled condensing units in batteries of nine units each on each of eight floors should be the solution for one such apartment building in Florida. A single unit serves each apartment. A meter bank adjacent to each group, which permits individual metering, provides equitable billing for the operation of each unit. Look for this article on pages 140 and 141.

LETTER FROM THE EDITOR (Continued) --

The refinements necessary today in properly preparing fuel oil for complete combustion are explained very clearly by D. S. Frank in his article on pages 142 through 146. A major consideration is the evaluation of the viscosity-temperature relationship so as to obtain peak efficiencies. Mr. Frank stresses that even within a certain grade of fuel oil there may be wide variations in fuel oil characteristics which may adversely affect the combustion. Knowing these facts, the engineer will surely be in a better postion to locate trouble when it develops and how to prevent it in future installations.

In designing central incinerator installations for multi-story apartment buildings, it is the recommendation of G. H. Hama and L. C. Curley to provide a means for preventing negative pressures in the building. This suggestion is based upon a study made in a 22 story apartment building which is reported on page 147.

Several factors must be considered in the selection of boiler feed pumps and drives for any large boiler installation. J. C. Beres and R. W. Potts present such an analysis which they made recently for the pumps and drives to serve a new 265,000 kw electric utility power plant. This article is on pages 148 to 153, and I am sure you will find it to be very informative.

Proportional ratio controls for unit ventilators are now economically practical, according to James R. Winston in his article on pages 155 to 159. Mr. Winston explains how these controls function and how they provide constant classroom temperatures regardless of rapid changes in the outdoor weather.

The data sheet on pages 161 and 162 includes a nomograph that is a shortcut for finding exhaust hood air flow rates. Clyde F. Metzler is the author, and he says he has used the nomograph with good results.

The satisfactory operation of an induction unit air conditioning system depends to a large degree on the minimum quantity of primary air which should be supplied to the space. Hem C. Gupta presents engineering information for determining this quantity in his article on pages 163 to 166.

How to select and control end use heat exchange equipment for high temperature hot water heating systems is the "HPAC Engineering Data File" on pages 167-182. Engineering Editor Don Bahnfleth has prepared this special section, as he does each month after weighing volumes of information and opinions from many sources. For this report of current practice in designing the many types of heat exchange systems for comfort and process heating, and steam generation, he has studied many plans and specifications for several large HTHW jobs. He has also interviewed some of the leading consulting engineers who have designed these systems. This Engineering Data File is another one worth reading and keeping.

Two more interesting and timely reports of what happened last month at the Mechanical Contractors Association Convention are in the You'll Want to Know pages (49-54). Other timely news items from other segments of the industry are also reported in these pages.

Any comments you have about the articles in this issue, including the new Trade Literature Supplement (Part 2 of this issue) will be most welcome.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

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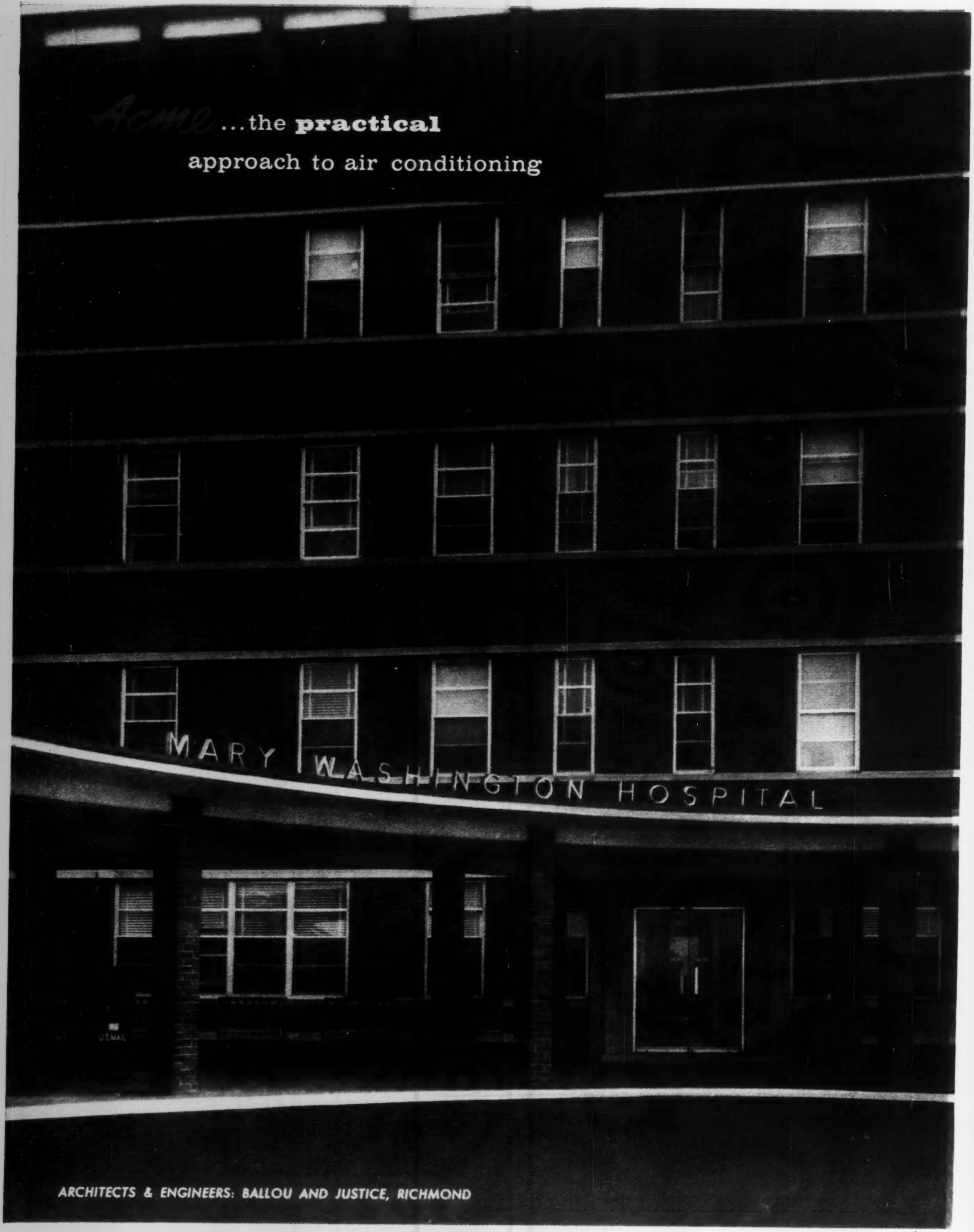
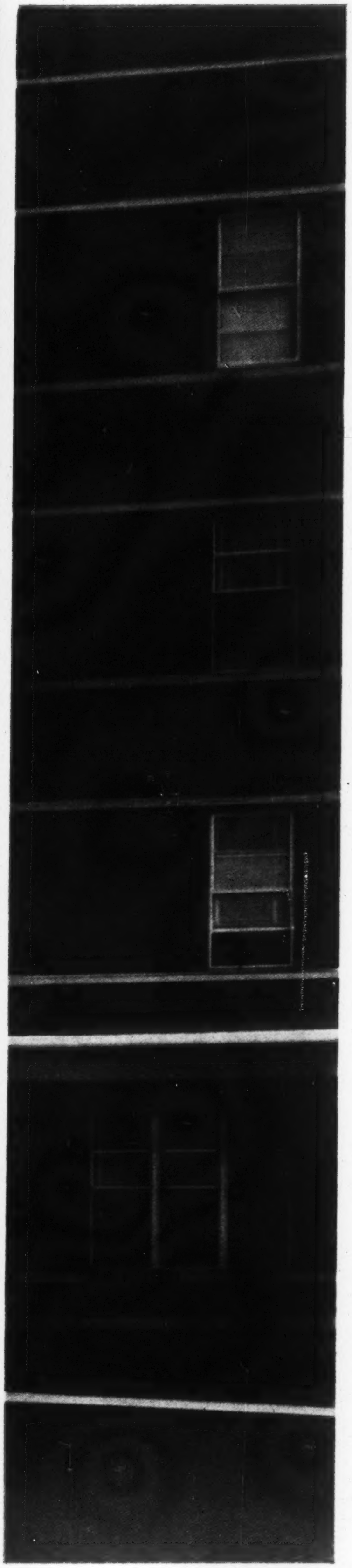

Acme ...the practical
approach to air conditioning
MARY WASHINGTON HOSPITAL
U.S.MAIL

ARCHITECTS & ENGINEERS: BALLOU AND JUSTICE, RICHMOND



For a growing hospital...
comfort conditioning
by Acme

Mary Washington Hospital, Fredericksburg, started back in 1899 in a five-room frame cottage. Today, after 61 years of progress and steady growth, the Hospital boasts 150 beds, a 20-bassinet nursery and completely modern facilities throughout . . . including Acme-system comfort conditioning for the recently added third and fourth floor nursing units.

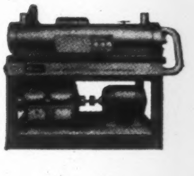
The patients, of course, are the primary beneficiaries of the year 'round comfort that Acme air conditioning provides but they're not alone in their appreciation, for John T. Ellington, Fredericksburg contractor who installed the system, had this to say . . . "When I take on a job, I prefer to buy from one manufacturer, if the equipment meets specifications. I selected Acme because their equipment not only met specifications, but was available for fast delivery so we could meet our deadline. Further, there were no installation problems with the Acme chiller, cooling tower or multi-zone air handler. These units are factory assembled and pre-tested . . . no need to assemble on the job. I just put them in the building and hooked them up."

Mr. Ellington stated, too, that "this June will complete two years of continuous operation and there hasn't been a service call involving the Acme equipment."

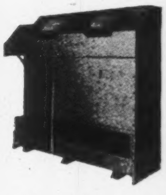
How can you beat it? . . . simple, low-cost installation . . . factory-tested performance reliability . . . minimum maintenance . . . client-pleasing operation. And all of this mind you, assured by a name that has stood for quality air conditioning and refrigeration equipment since 1919 . . . ACME.

Acme INDUSTRIES, INC.
JACKSON, MICHIGAN

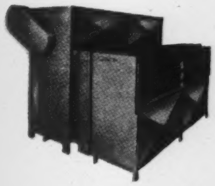
Manufacturers of Quality Air Conditioning and Refrigeration Equipment Since 1919



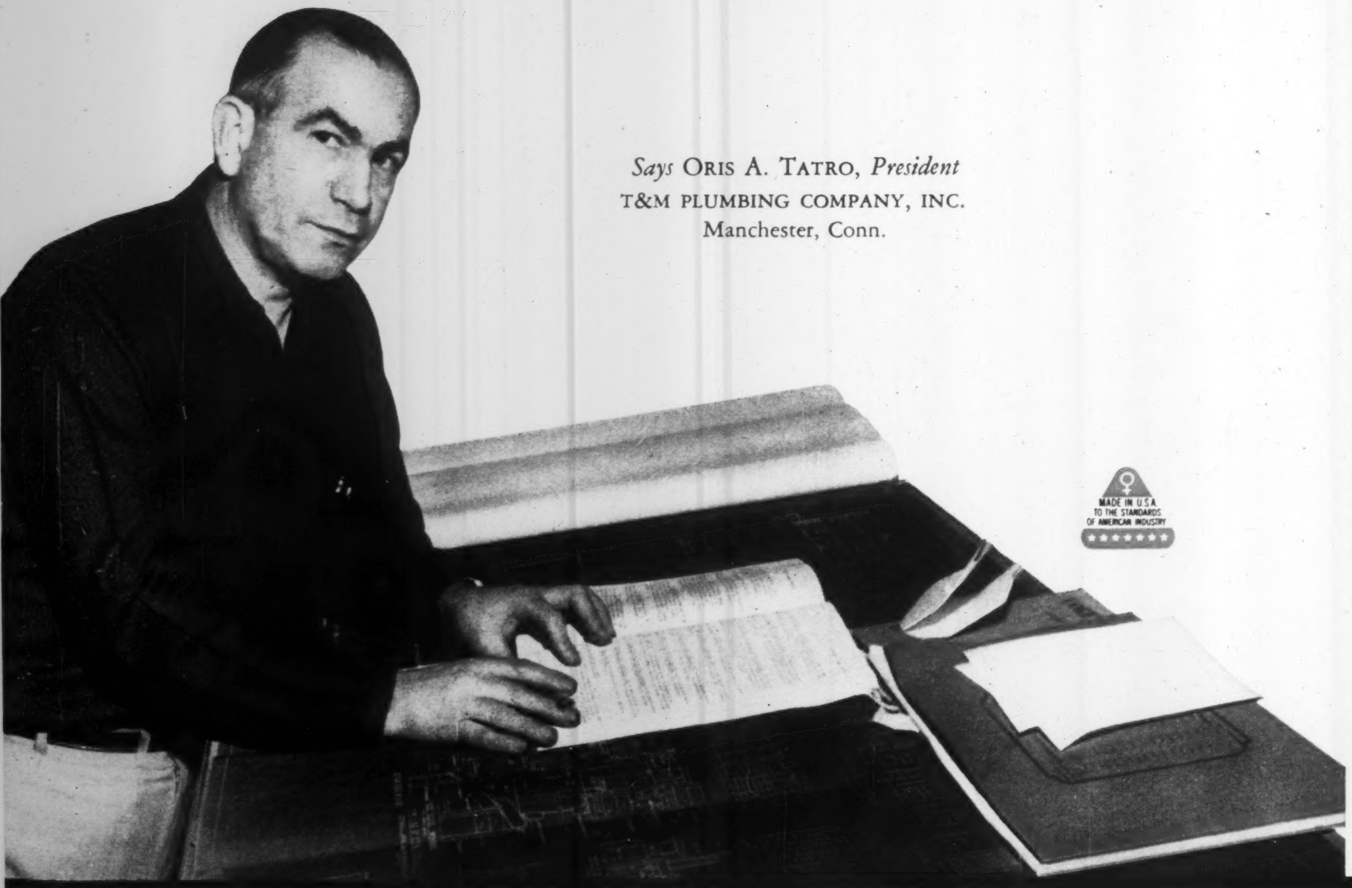
Packaged Chillers
1½-250 tons



Cooling Towers
3-120 tons



Air Handlers
665-47,000 cfm


MADE IN U.S.A.
TO THE STANDARDS
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Says ORIS A. TATRO, *President*
T&M PLUMBING COMPANY, INC.
Manchester, Conn.

"Copper DWV Lines make possible a quality job at No Extra Cost...

While grease test proves copper best . . . stoppage nil"

Continued Mr. Tatro, "If you have any doubts as to the quality of the job you can turn out with DWV copper water tube for the same amount of money as rustable lines, you should have seen the Capehart Housing Project at Ft. Monmouth, N. J.

"We would have been able to show you how men, with practically no experience in working with copper tube on the job site, or prefabricating it in the shop, were able to turn out the best quality job possible at the same price as rustable material.

"The pictures shown here can tell you better than I the many time-saving advantages of working with DWV. And speaking of DWV I'd like to point out one thing: after ten years with copper, we have found stoppage of kitchen sinks, where copper drainage lines had been used, to be nil. Make the test shown at right; you'll soon see why.

"Another thing I'd like to add: a copper installation is made to last, and it does."

You, too, will find that it costs no more (often less) to install a 100% copper job, than it does to use rustable pipe.

Engineers, contractors, home builders and architects have also found that copper water tube is equally important for use in air conditioning lines, radiant panel heating, oil burner and processing lines. It's also important that you specify a particular brand . . . Revere—oldest name in copper.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801
Executive Offices:
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Mills: Rome, N. Y.; Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities. Distributors Everywhere.

PICTURES TELL THE MONEY-SAVING STORY OF REVERE COPPER WATER TUBE & DWV

• • • •

1. CAPEHART HOUSING PROJECT—U.S. Army Base, Ft. Monmouth, N.J., where 27,320 ft. of Revere Copper Water Tube were used for hot and cold water lines, drainage, waste and vent lines, in 130 units, 33 buildings.

2. SHOP PREFABRICATION—means non-leak joints under ideal working conditions with jigs speeding up operations and making multiple bends a cinch. Saves installation time.

3. DWV "TREES" can be prefabricated too, because even the long lengths are so light one man can handle with ease.

4. ONE MAN and a pick-up truck can load and unload all the materials and prefabricated sections needed for a full day's work, in a matter of minutes.

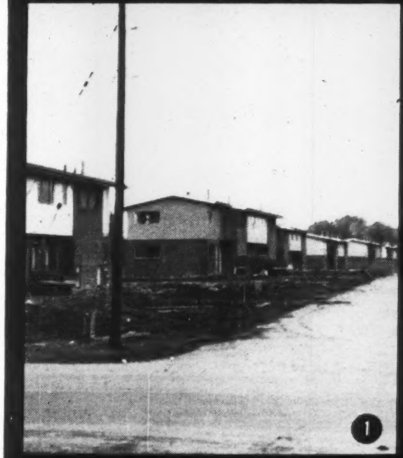
5. 2 PLUMBERS and a helper, in one day, installed all the plumbing and drainage lines to complete 2 houses a day, each building having 4 apartments. Think of all the time involved if threaded pipe and fittings had been used.

6. WITH prefabricated sections, plumbing and DWV lines can be roughed in at the same time framing is put in place.

7. GREASE TEST PROVES COPPER DOES NOT CLOG as does rustable pipe. Both copper and ferrous pipe (2") were lined with 3 oz. of lard. Then, 140° F. water was run through both simultaneously using a "Y" fitting. The lard left the copper tube within 8 seconds due to high conductivity of copper, the low mass and its gun-barrel smoothness . . . with no trace of residue. It took 29 seconds for the lard to leave the ferrous pipe. Note residue. It doesn't take long for grease to pile up in amounts sufficient to cause clogging when drainage lines are ferrous pipe. Photos are unretouched. Arrow points to lard leaving copper tube.

• • • •

General Contractor: B. J. LUCARELLI, Newark, N. J.
Revere Dist.: KANTOR BROS., Inc., Newark, N. J.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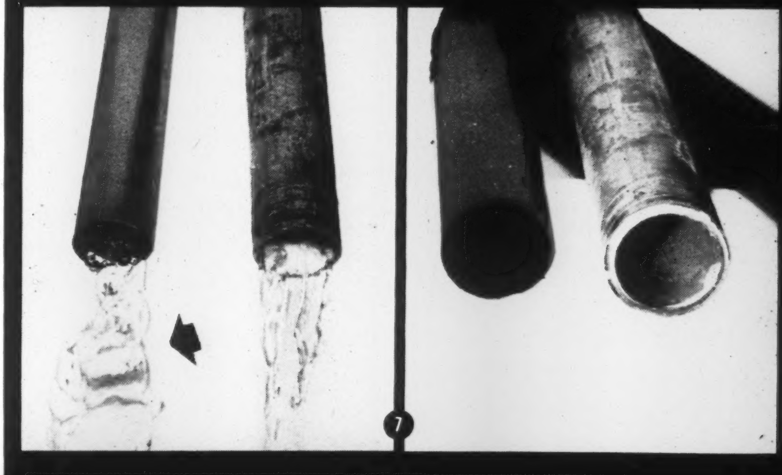
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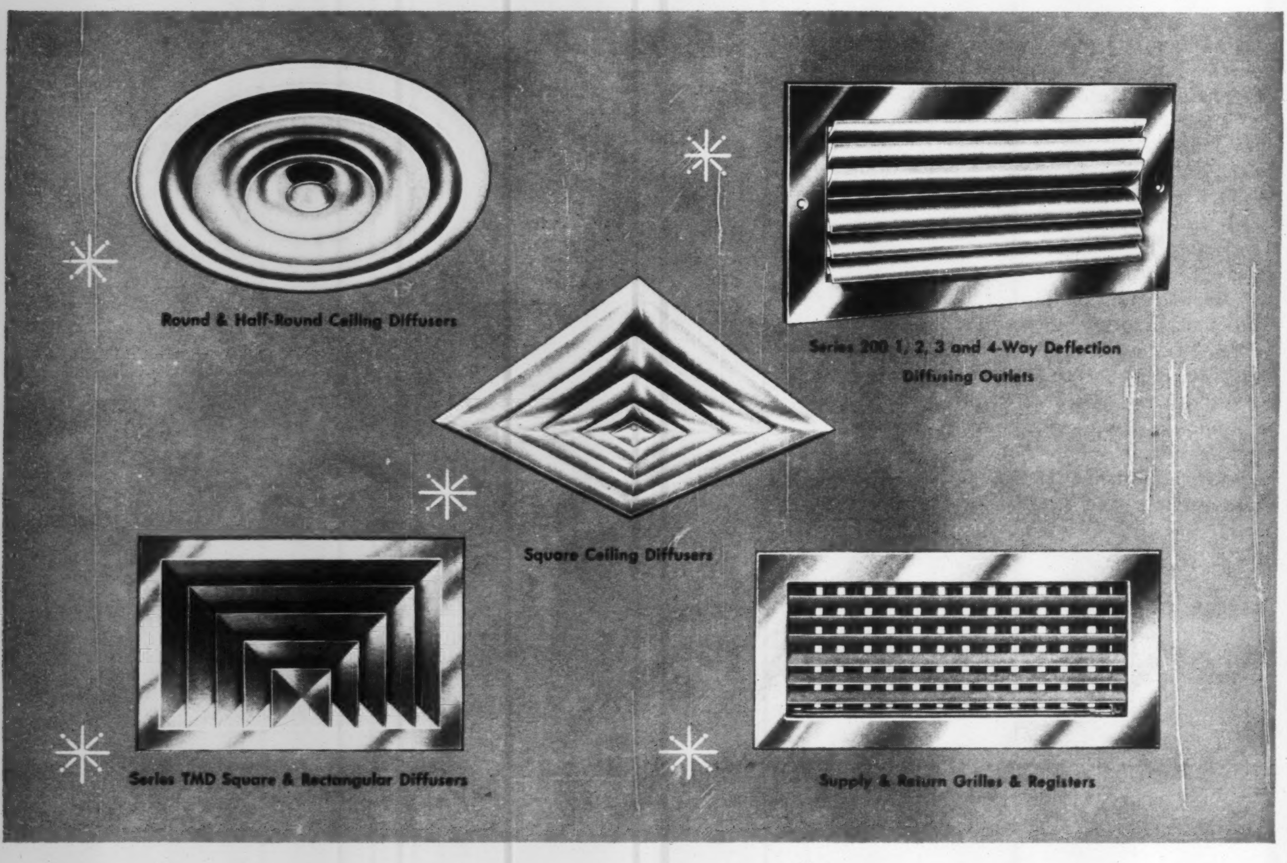
for outstanding design in the CONVENTIONAL . . .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Series 200 1, 2, 3 and 4-Way Deflection Diffusing Outlets
Square Ceiling Diffusers
Series TMD Square & Rectangular Diffusers
Supply & Return Grilles & Registers

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Whether you want the best in *CONVENTIONAL* air diffusion equipment . . . or the *SUPERB* in extruded aluminum . . . you can get it at TITUS! For Titus has just made air conditioning history. *Never before has anyone . . . anywhere offered such a large, complete line of quality grilles, registers and diffusers.* You really benefit when you specify from ONE RELIABLE, COMPLETE SOURCE. One source means one responsibility . . . faster, accurate delivery of orders. And Titus' large, complete line *eliminates any need to compromise in product selection.* You can select the *exact* outlet to fit the job . . . YOUR GUARANTEE OF THE MOST EFFICIENT AIR DIFFUSION. Titus extruded aluminum diffusers are made of the very finest aluminum extrusions *from Titus' own extrusion presses.* Titus also *custom makes* extruded aluminum diffusers, grilles and louvers to fit *any* specification. For full details, write: *Titus Custom Design Engineering Dep't,* or contact your nearest Titus representative.

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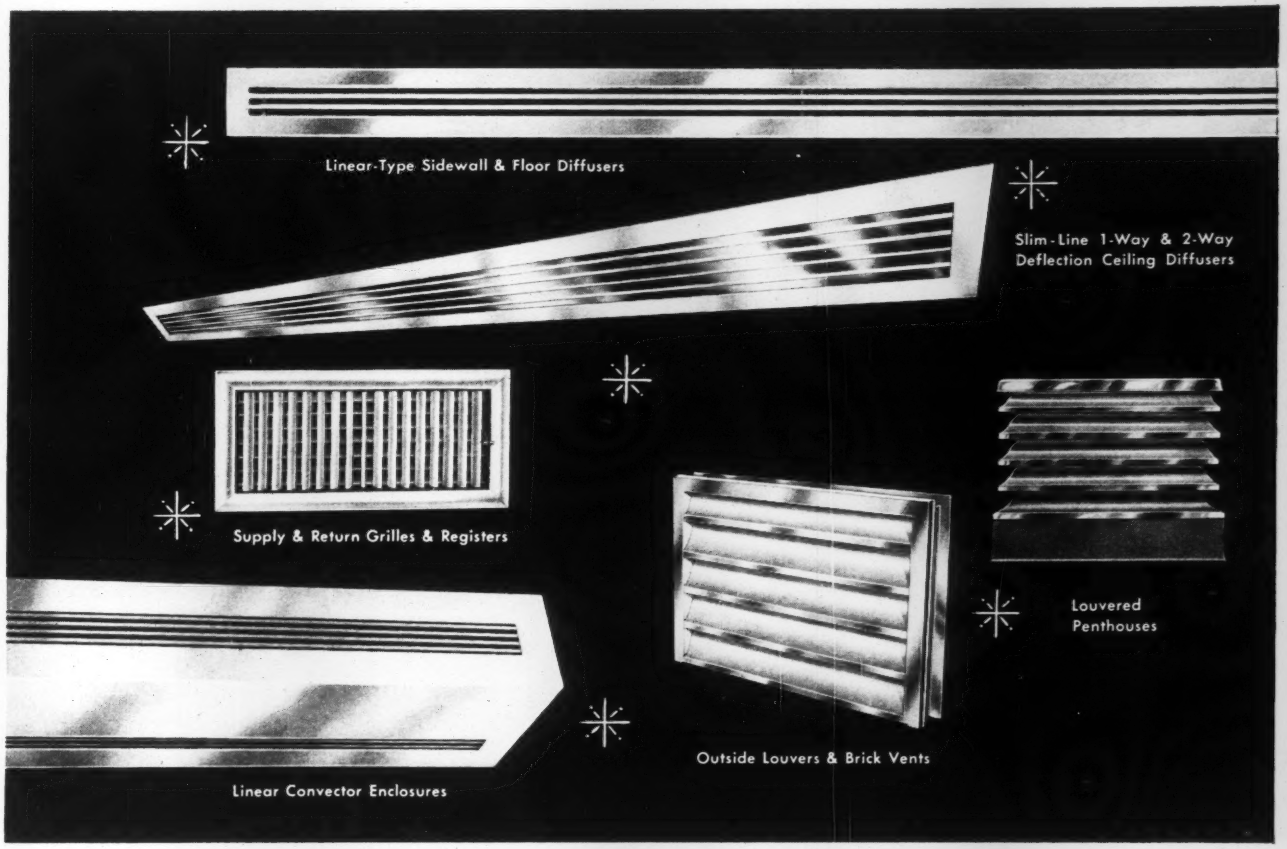
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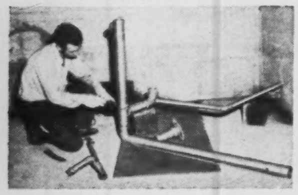
Available through plumbing wholesalers. Products of The American Brass Company

Longer Lengths—Few Joints



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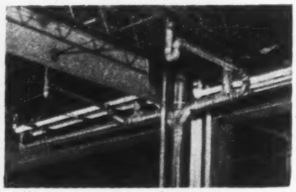

Compact Connections—Save Space

TACO
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Body
Permanently
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A new smaller size perfecta circulator

Now, the new Perfecta 152 brings you added cost-savings for most residential installations. Smaller in size than the popular Perfecta 150, the "152" means a lower initial investment. What's more, it *installs* fast in tighter spots . . . *saves* you *time* and *money*. And, of course, its famous Perfecta simplified design features assure trouble-free performance . . . save you unprofitable "call backs". There are no seals to leak, wear, or create extra friction. Impeller, rotor, and shaft are assembled as a single unit. It's permanently *water-lubricated* and power-saving. Many other extras. Why not take advantage of Perfecta versatility and economy on your next installation? For complete specifications, write TACO HEATERS, INCORPORATED, 1160 Cranston Street, Cranston 9, R. I.

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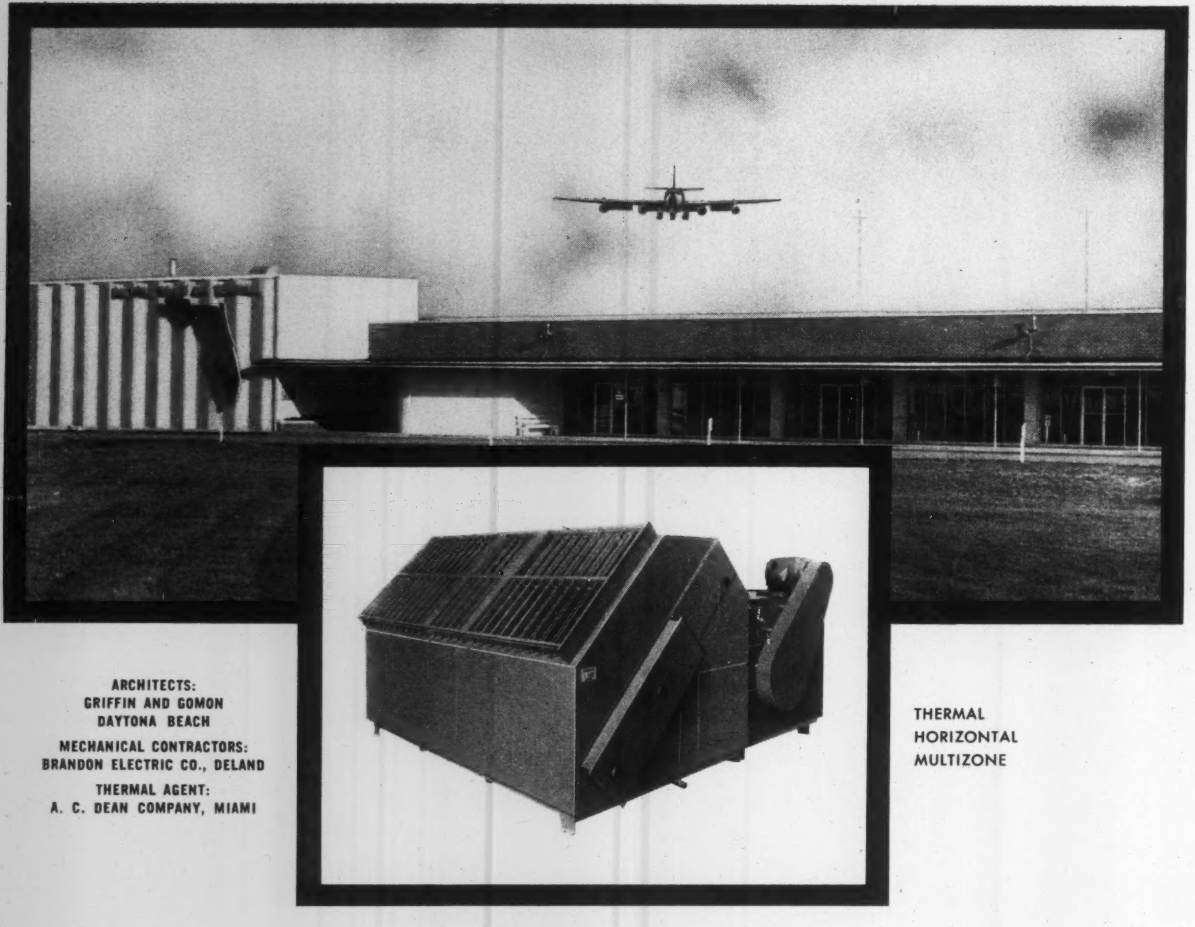

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To match the comfort and luxury of today's air travel, architects and engineers give considerable study to the design of and equipment needed in air terminals. Among the country's outstanding terminals in this aspect is the one found at Daytona Beach, Florida.

And here again, as in more and more outstanding buildings, Thermal Engineering's equipment is in use. Both cooling and heating are being furnished by Thermal multizone and central plant units to provide year 'round air conditioned comfort on the ground for air travelers.

Thermal Engineering manufactures a complete line of finer air conditioning and ventilating equipment for every climate and to fit all architectural requirements. To see how easily, economically and efficiently Thermal equipment will fit into your new building or remodeling plans, write for the complete catalog on Thermal central plant and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils, and air-cooled condensers.

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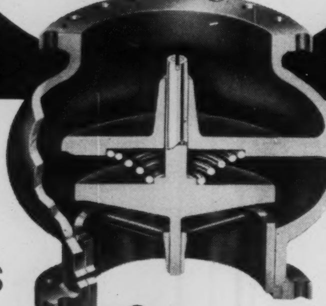
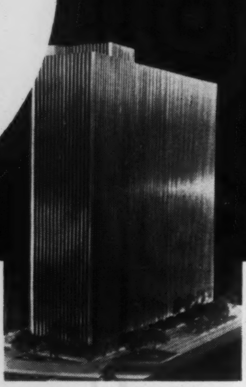
Owned and Operated by THE EQUITABLE LIFE ASSURANCE SOCIETY OF THE UNITED STATES

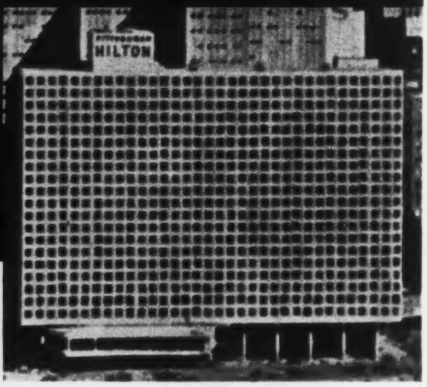
In Pittsburgh—One, Two and Three Gateway Center

Pumps Start and Stop Instantly... with NO WATER HAMMER





New Four Gateway Center



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WILLIAMS-HAGER Silent Check Valves

Air conditioning for these five fine buildings is furnished from a centralized pumping system—with ten *Silent Check Valves* in the condenser system, five in the chilled water system. The valves also are used on domestic water systems for some of the individual buildings.

By operating whenever flow reversal starts or when flow is zero, the valves allow pumps to be put on or removed from the line immediately, with no need for hand-operated valves.

Write for Bulletins:
No. 654 on the Valves; No. 851 on Cause, Effect and Control of Water Hammer.

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General Contractor: Starret Brothers and Eken, New York
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General Contractor: The George A. Fuller Company, New York
Piping Contractor: Wayne Crouse, Inc., Pittsburgh
Mechanical Engineer: Meyer, Strong and Jones, New York

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Mechanical Contractor: Limbach Company, Pittsburgh

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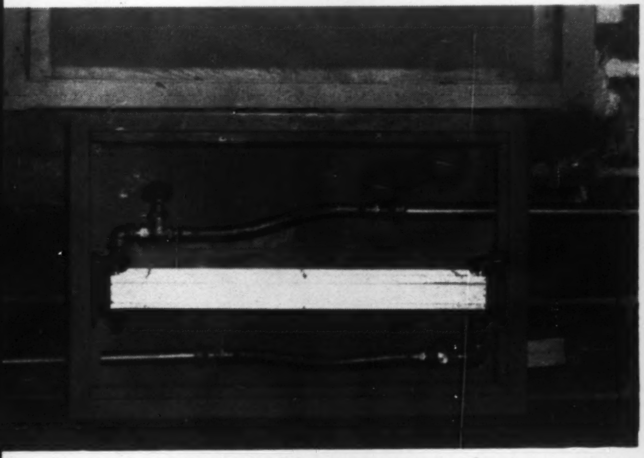
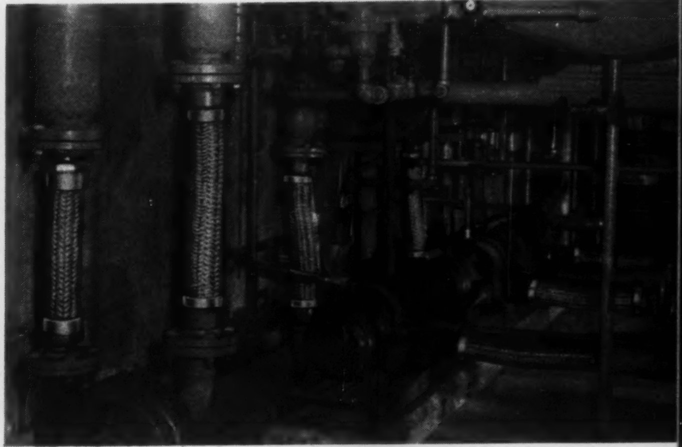
APPLICATION HINTS:

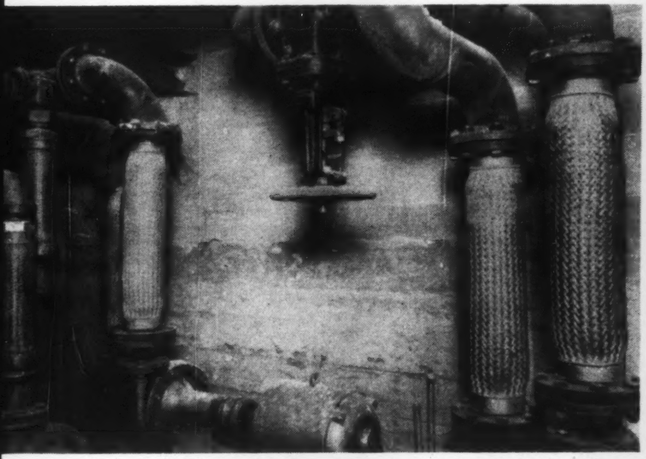
Ways to simplify construction and cut costs with Flexpipe



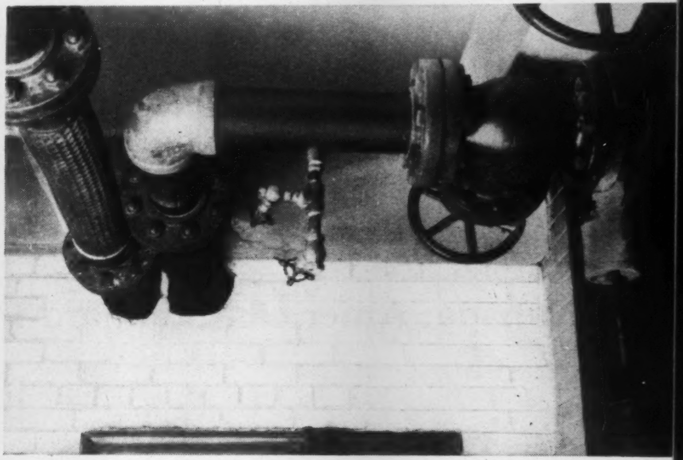
Cut total piping costs of heating systems. Flexpipe connectors handle offset and riser expansion—eliminate the need for extreme accuracy in roughing-in—eliminate time and cost of through-floor connections, hung ceilings and furred out walls. Piping can hug the wall, saving floor space. Flexpipes are used to simplify design and installation in both steam and hot water heating systems.



Save space, absorb vibration, cut installation time in air conditioning systems. In larger heating and cooling systems, Flexpipes take up movement caused by expansion and contraction in piping—absorb vibration from pumps—require less space—install easily in tight quarters—even when outlets do not line up—cut costs of using short lengths of pipe and elbows.



Handle expansion on long horizontal runs in big hot water jobs. Modern schools and institutions of multi-structure design involve long horizontal runs for hot water heating mains. Using Flexpipes to take up expansion and contraction in the mains can often eliminate the need for expansion bends—make possible smaller, more economical tunnels—simplify and speed installation—reduce maintenance. Flexpipes also dampen pump vibration and minimize transmission of noise along the heating mains.



Meet big, tough piping problems. Flexpipes have the flexibility and strength to handle many unusual and complex jobs. These are available in sizes through 16" I.D. in tin bronze, stainless steel or hot-dipped galvanized steel. In the installation above, Flexpipes helped solve some difficult problems in air conditioning a large office building. Flexpipes connect risers and branch pipes, handle movement up to 2 inches in the spring-mounted risers, and water pressures up to 400 psi at lower floors.

WHERE TO BUY: Leading plumbing and heating supply houses can provide you with information about Flexpipe in standard sizes. For the name and address of the distributor serving your area, or for more detailed information, write to: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 60158

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an
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Now, from American-Standard Industrial Division comes a new line of Airfoil Bladed Fans that exceed 90% in mechanical efficiency. A completely new design, these fans carry AMCA certified ratings, and are built for both general ventilation and industrial process applications. They are available in 27″ thru 108¾″ wheel diameters—in single and double inlet designs, with volumes from 3000 to 500,000 cfm. Send for Bulletin A1103. American-Standard Industrial Division, Detroit 32, Mich. In Canada: American-Standard Products (Canada) Ltd., Toronto.

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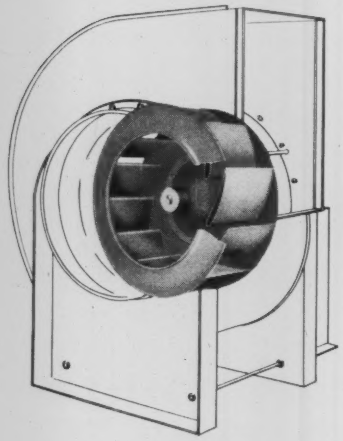

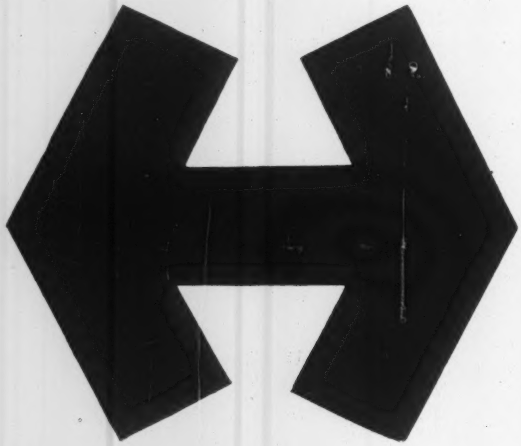

CERTIFIED RATINGS

Certified Ratings are the result of tests made by the manufacturer in accordance with Standard Test Codes adopted by the Air Moving and Conditioning Association, Inc. Air Moving and Conditioning Association, Inc., is successor to Industrial Unit Heater Association, National Association of Fan Manufacturers, Inc., and Power Fan Manufacturers Association.

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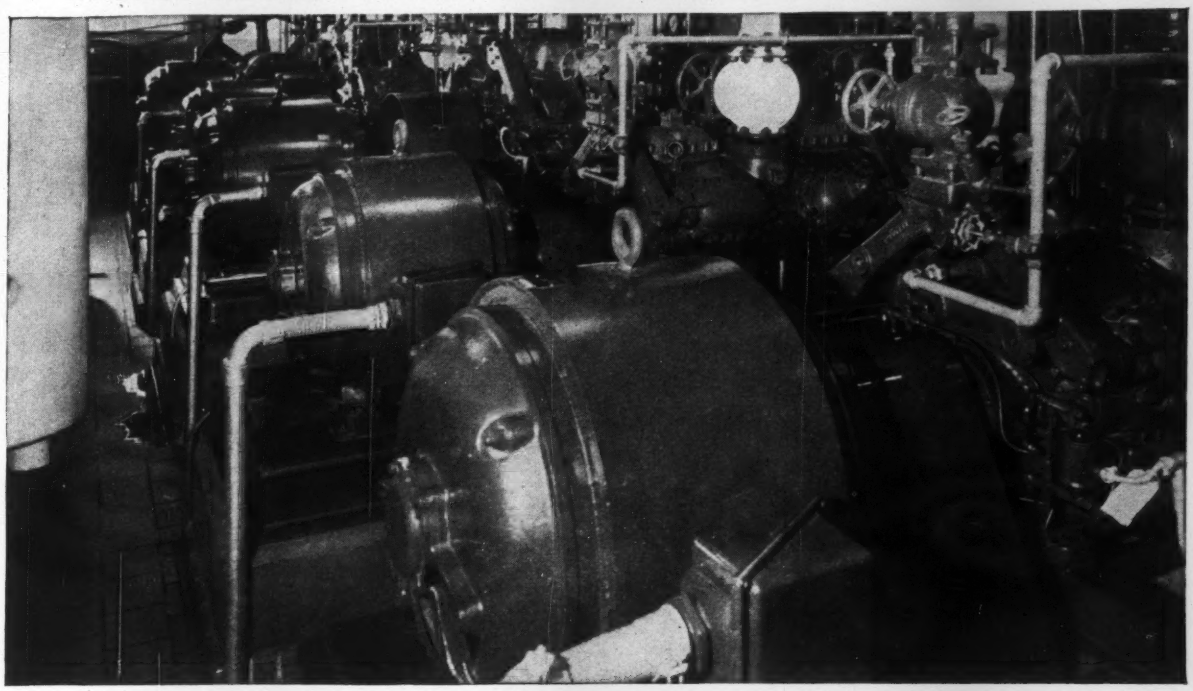
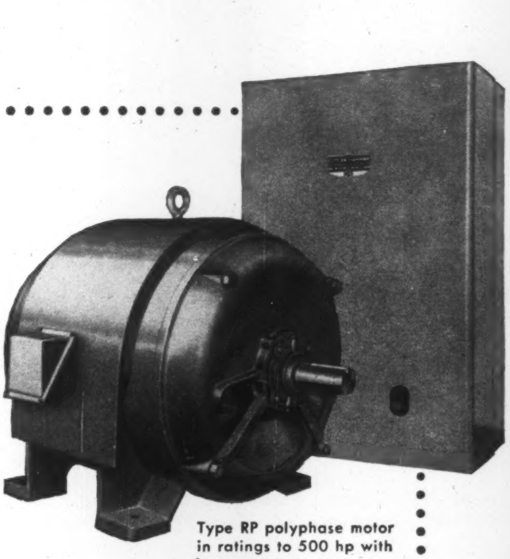
WAGNER ELECTRIC MOTORS . . . THE CHOICE OF LEADERS IN INDUSTRY



End Voltage Drop and Line Disturbance Problems caused by starting BIG MOTORS...



Type RP polyphase motor in ratings to 500 hp with increment type starter.

Use Wagner Increment Motor-Starter Combinations

Increment starting is the easy, inexpensive way to limit the inrush of starting current in motors up to 500 horsepower. And, you do it *best* with Wagner Increment Motor-Starter Combinations . . . polyphase open-type, totally-enclosed, or explosion-proof motors and magnetic increment starters.

Line disturbances are reduced because current taken from the line is not broken during the starting period. Motors start sure and fast . . . reach full speed in a matter of seconds. And . . . Wagner combinations cost less than motors with primary resistance or auto-transformer type starters.

Two more plusses: The compact, relatively lightweight starter is easy to connect . . . needs very little attention. The motor requires only regular inspection, cleaning, and lubrication . . . maintenance is minimized.

While 2-step combinations are suitable for most applications . . . 3, 4, 5, or 6-step increment motor-starter combinations are available for installations where unusually low inrush of starting current is required. All meet the polyphase motor-starting requirements of AEIC-EEI-NEMA.

It's possible you can save money on your big jobs with Wagner Increment Motor-Starter Combinations. A Wagner Sales Engineer will help you. Call the nearest Wagner branch or write us for Bulletins MU-128 and MU-195.

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Fresh Air Supply Heaters
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Unit Heaters
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Duct Heaters
Duct Heater Assemblies

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Gas-fired Duct Heaters for use where the heat must be moved through ductwork to other areas for proper utilization.

Gas-fired Duct Heater Assemblies for large areas. These units, which are available with two, four or six heaters, coupled with the proper choice of one of the many Wing fixed or revolving discharges, can cover areas ranging up to 132′ square.

Gas-fired Fresh Air Supply Heaters — for supplying fresh, heated make-up air to increase the efficiency of exhaust systems, provide positive pressures that prevent drafts and cold air leaks into the building. Increase workers' comfort. Available for roof or wall mounting.

These gas units, as with all Wing heating equipment — gas, steam, hot water or electric — are manufactured to provide low installed and operating costs.

For complete catalog data on all these Wing products write today or contact your local Wing representative

WC132

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WING

Johnson Control Systems Are Backed by the Largest and Most Experienced Service Force in the Control Industry

Efficient temperature control will be just as essential in your clients' buildings in 5, 10, 20, or more years as it is today.

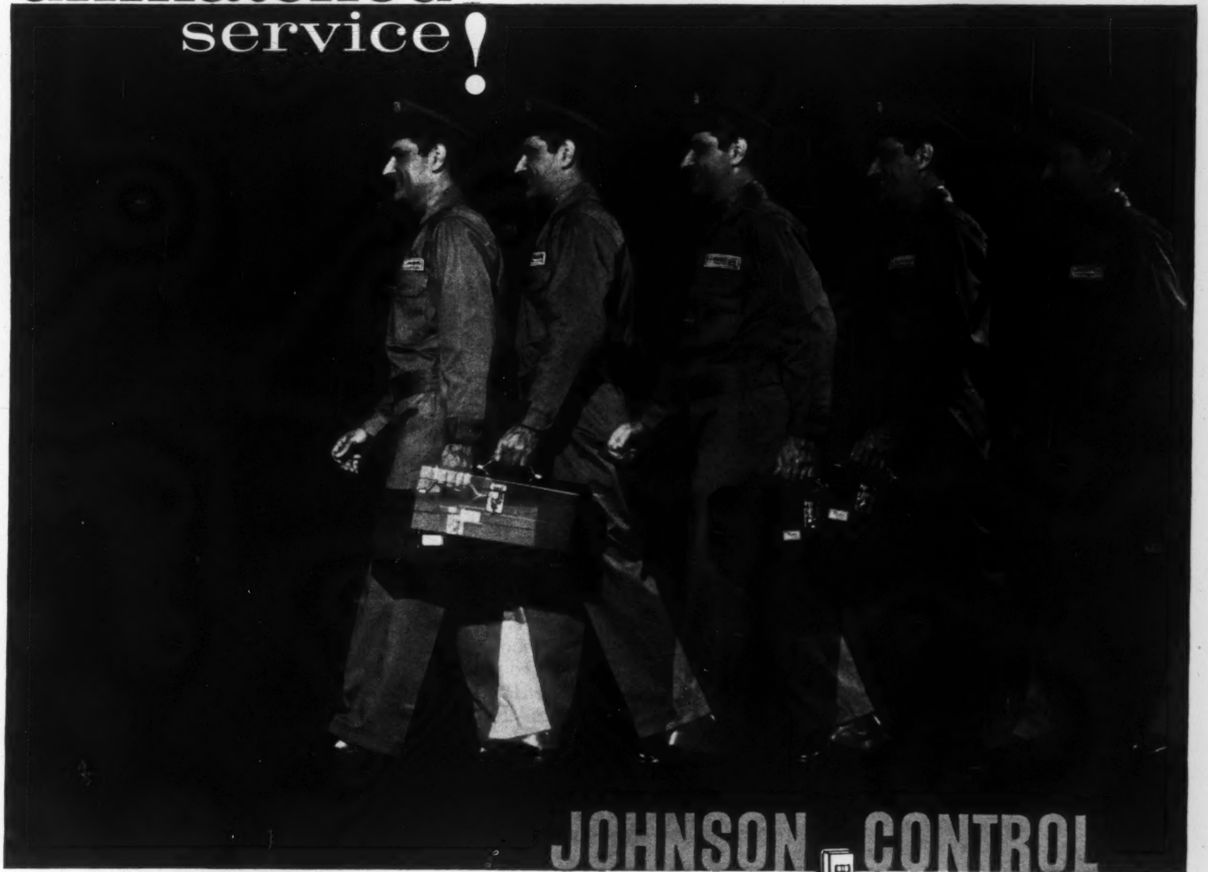
That's a key reason to specify Johnson Pneumatic Control Systems, for it is traditional Johnson policy that *future service is as important to owner satisfaction as the original sale.*

That is why Johnson maintains the largest and finest service organization in its field. Full-time, factory-trained service mechanics are stationed in hundreds of cities across the nation. These maintenance and repair experts make it easy for every client to keep his Johnson Temperature or Air-Conditioning Control System operating at peak efficiency throughout the life of his building.

With a Johnson Pneumatic Control System, your clients avoid the annoying delays, guesswork, and inflated costs of depending on non-specialists for service.

Unmatched service is just one of many advantages you and your clients get with Johnson Control. Your local Johnson representative will be glad to supply full details. Johnson Service Company, Milwaukee 1, Wisconsin.

unmatched service!



JOHNSON CONTROL

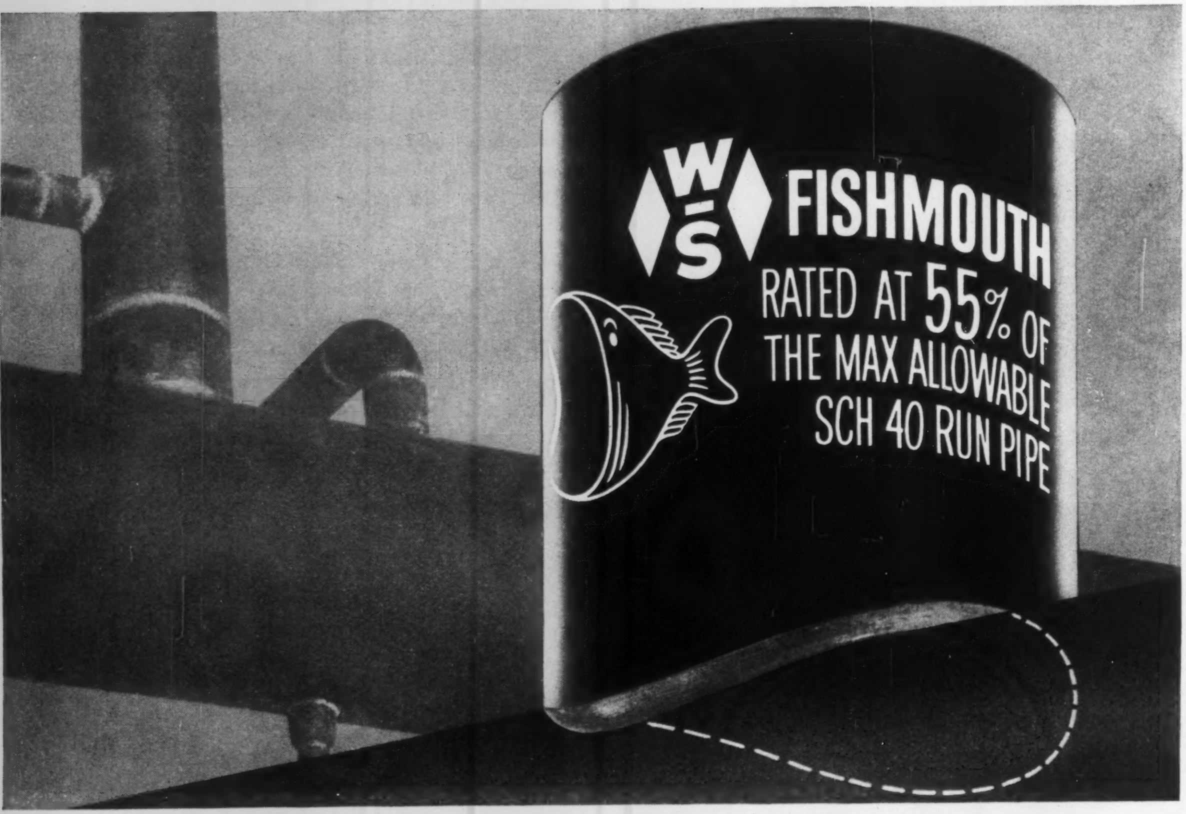
PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

For Branch Connections 2 inches or over:

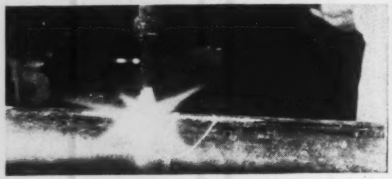
FISHMOUTH:

TRY THIS NEW WELDING FITTING;
2" SIZE COSTS ONLY 81¢
GIVES STRONG, LEAK-PROOF JOINTS!



IT'S THE MOST PRACTICAL WAY TO MAKE A BRANCH CONNECTION

Mark



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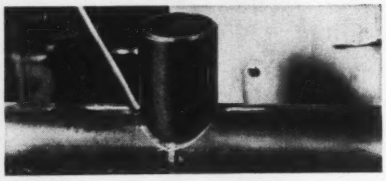


Weld

The W-S FISHMOUTH saves 50 percent or more over commercially available branch fittings. Made from Schedule 40 pipe, W-S FISHMOUTH is fully machined and perfectly shaped for strong, leak-proof joints. A ready-made W-S FISHMOUTH is rated for working pressures up to 55% of maximum run-pipe limits (for instance, it is rated at 350 PSI for 6", Schedule 40 run pipe with a 660 PSI rating).

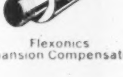
No time or cost required to shape, fit or bevel. Ideal for close-quarter work. Easy access to inspect weld penetration or to backweld. W-S factory machining means a secure, permanent installation every time.

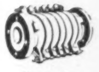
Ready-made, the W-S FISHMOUTH costs less to buy and to install than anything on the market. Sizes: 2" to 12" IPS, butt weld ends. Fewer sizes handle many more jobs, eliminate need for special fittings. Write today for complete information, prices and names of distributors to: Forge & Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, N. J.

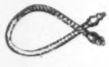
FORGE AND FITTINGS DIVISION **PORTER** ***H.K.PORTER COMPANY, INC.***

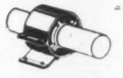
PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

the only complete line to handle every pipe movement problem!


Flexonics Expansion Compensators


Flexonics Expansion Joints


Flexonics Flexible Connectors

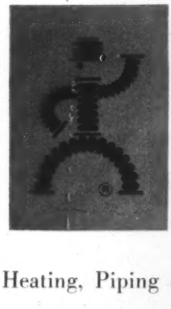

Flexonics Pipe Guides and Supports

Wherever there's pipe movement . . . thermal growth . . . vibration . . . there's a Flexonics product to absorb, guide, or control it.

Flexonics Corrugated Expansion Joints are expertly engineered to your needs, hydraulically formed, metallurgically treated by exclusive techniques, for maximum cyclic life. **Flexonics Expansion Compensators** offer the lowest-cost way, inch for inch, to absorb thermal growth in pipes or tubing 3″ and smaller. **Flexonics Flexible Connectors** absorb vibration, permit random movement in pipes up to 24″. **Flexonics Pipe Alignment Guides** and Roller Pipe Supports provide better guiding than old-fashioned methods, yet they cost less. **Check and mail the coupon today.**

EJMA **Member Expansion Joint Manufacturers Association**

EJ-255



Flexonics
corporation

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ont.

EXPANSION JOINTS · METAL HOSE · SYNTHETIC HOSE · BELLOWS · AERO/SPACE COMPONENTS

SUBSIDIARY OF CALUMET & HECLA, INC.

ATTACH TO YOUR LETTERHEAD—MAIL TODAY!

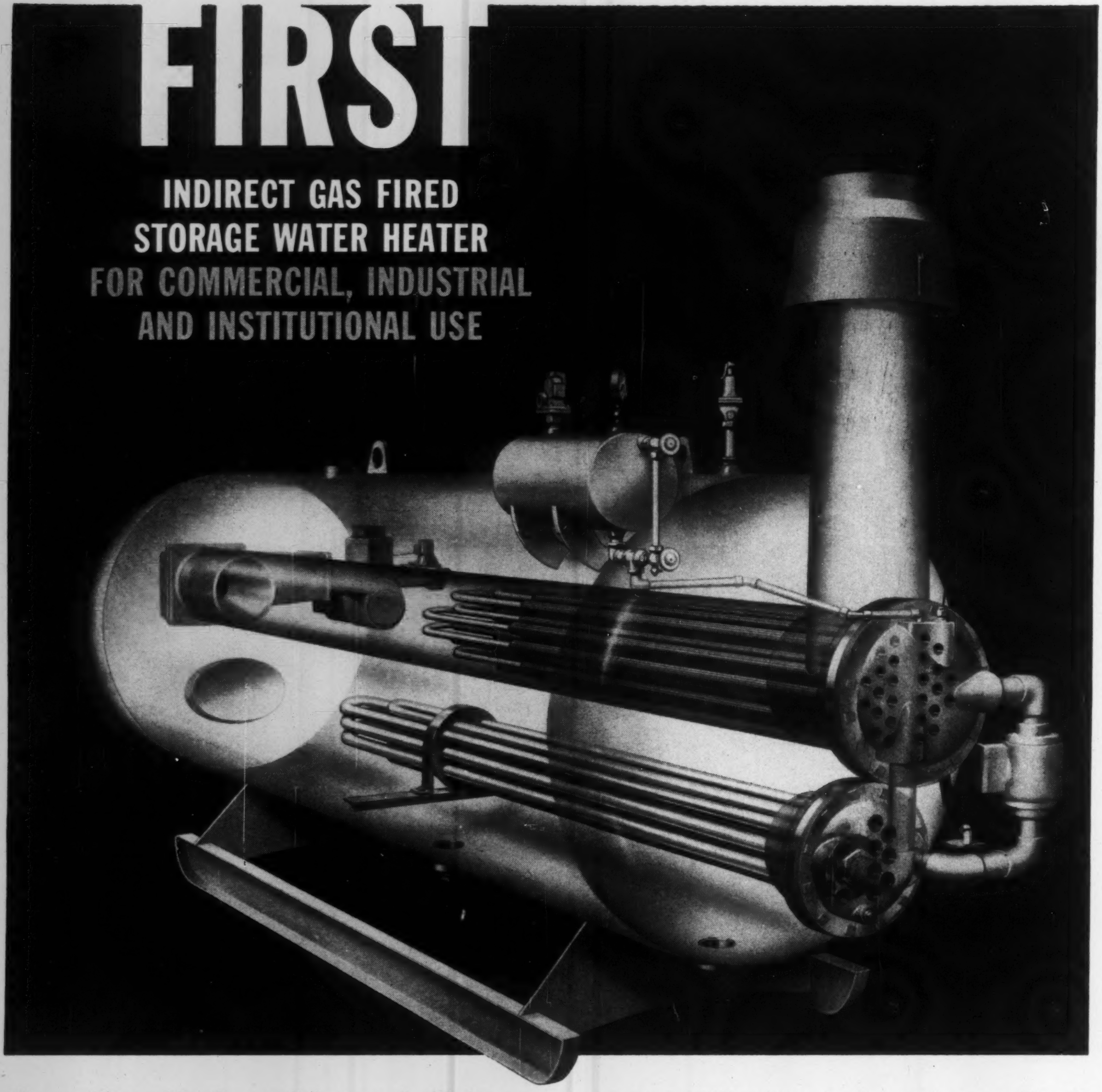
Flexonics Corporation
1391 South Third Avenue
Maywood, Illinois

Please rush me complete information on

- ☐ Expansion Joints
- ☐ Expansion Compensators
- ☐ Flexible Connectors
- ☐ Pipe Guides and Supports

FIRST

INDIRECT GAS FIRED STORAGE WATER HEATER FOR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL USE



No scaling • No drop-off in rated efficiency • No fuel waste • No on-the-job assembly • No complicated maintenance • No limitations on placement • Fully automatic • Copper heating surface

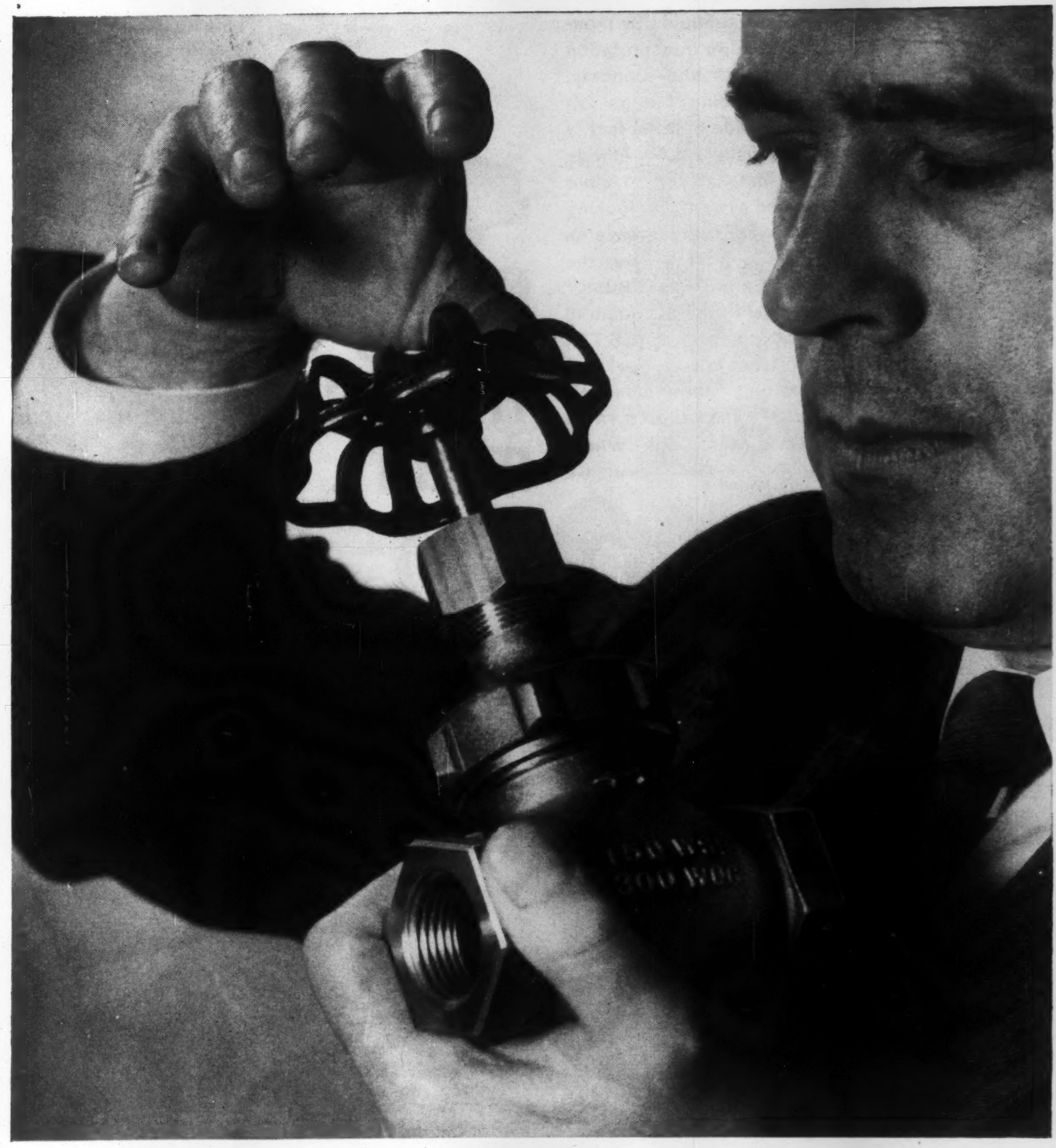
P-K SCALEFREE 230* is a unique rugged unit backed by P-K's 80 years of experience in building and designing quality water heating equipment. It heats water through hot intermediate distilled water. Transfer occurs below the temperature at which minerals that cause scaling precipitate. Efficiency remains unimpaired throughout service life. Linings of pre-Krete or copper are available to keep the unit free of rust and corrosion regardless of water conditions.

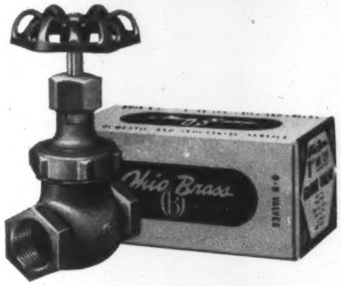
SCALEFREE 230 features a new P-K gas burner. It operates at maximum practical efficiency. Yet it gives almost noiseless service—does not rumble or boom on startup. This permits location almost anywhere in office buildings, institutions, schools, motels, etc.

SCALEFREE 230 is a complete fully automatic package that can be quickly set in place, hooked up and checked out. It is available in more than 100 storage and recovery combinations. Storage capacities range from 250 to 4000 gallons. Recovery sections range from 390,000 to 2,215,000 Btu. Write for catalog with full information.

*Patent pending

Patterson Kelley
102 Morgan Ave., East Stroudsburg, Pa.





MEN WHO OPERATE VALVES like the *sure grip* they get on an O-B handwheel—find it's contoured to fingers, safely non-heating and won't slip under wet or greasy grasp! Just one of many advance-planned features you get by standardizing on the complete O-B bronze valve line. Ask your distributor for the valve in the orange-and-black box.

OHIO BRASS COMPANY • Mansfield, Ohio

O·B VALVES

HOLAN

10073-V

Whether by automobile or movement of gases and liquids by pipeline, today's trend in transportation is toward efficiency and economy. **HUSKY** steel welding fittings are designed to provide both. In fact, a welded system using **HUSKY** fittings can now be installed for no more than a threaded system. Or, looking at it another way, you can save as much as 85% per fitting over the welded fittings now in use! **HUSKY** fittings are ideal for all Schedule 40 piping and fully comply with A.S.T.M. A234 specification . . . perform admirably at much lower cost. *

ASK FOR FULL PARTICULARS FROM YOUR WHOLESALER . . . OR WRITE NIBCO INC., Dept. K-6406, Elkhart, Ind.

Husky fittings mean compact transportation, too!

S40-WPB
NIBCO
MADE IN USA

HUSKY
90°
ELBOW

HUSKY
STANDARD
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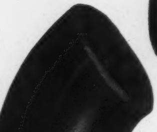
HUSKY
REDUCING
TEE

HUSKY
ECCENTRIC
REDUCER



HUSKY
45°
ELBOW

HUSKY
CONCENTRIC
REDUCER

PHCIB
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* Current jobs where **HUSKY FITTINGS** are being used include the following: **CANDLESTICK PARK STADIUM**, San Francisco, California; **JEFFERSON DAVIS HOSPITAL**, Houston, Texas; **WILLIAM WINLOCK MILLER HIGH SCHOOL**, Olympia, Washington; **MERCHANTS NATIONAL BANK AND TRUST COMPANY**, Indianapolis, Indiana; **CIVIL AERONAUTICS ADMINISTRATION CONTROL CENTER**, Fremont, California.

HUSKY
STEEL
WELDING
FITTINGS

FROM
AMERICAN-STANDARD
INDUSTRIAL
DIVISION

AIR-LIFT[†] FOR MODERN SHOPPING CENTERS

Air-Lift, a new concept of coordinated products and services from American-Standard Industrial Division, helps you boost the selling efficiency of modern shopping centers through better indoor climate control. Air-Lift gives you one-source responsibility for air-conditioning, heating, and ventilating equipment designed and manufactured to work together.

LIFT THE FLAP

Produc

Heating ar

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ONE-SOURCE RESPONSIBILITY . . . the heart of American-Standard Industrial Division's Air-Lift Service. Now—with the combined American Blower, Ross Heat Exchanger, and Kewanee Boiler product lines—American-Standard* Industrial Division offers all the major components for complete, integrated air-conditioning systems. You benefit by getting heating, cooling, refrigerating, and ventilating equipment designed, engineered, and manufactured to work together. And, most important, you have one-source responsibility for its quality and performance. Offices in all principal cities are staffed by product specialists whose practical knowledge of the selection and application of air-conditioning equipment may prove most helpful to you. May we serve you? American-Standard Industrial Division, Detroit 32, Michigan. In Canada: American-Standard Products (Canada) Limited, Toronto, Ontario. Export Division, American-Standard, New York City.

AMERICAN-Standard

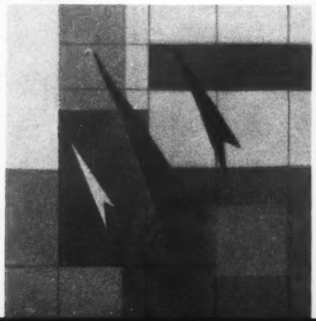
INDUSTRIAL DIVISION

AMERICAN BLOWER PRODUCTS • ROSS PRODUCTS • KEWANEE PRODUCTS

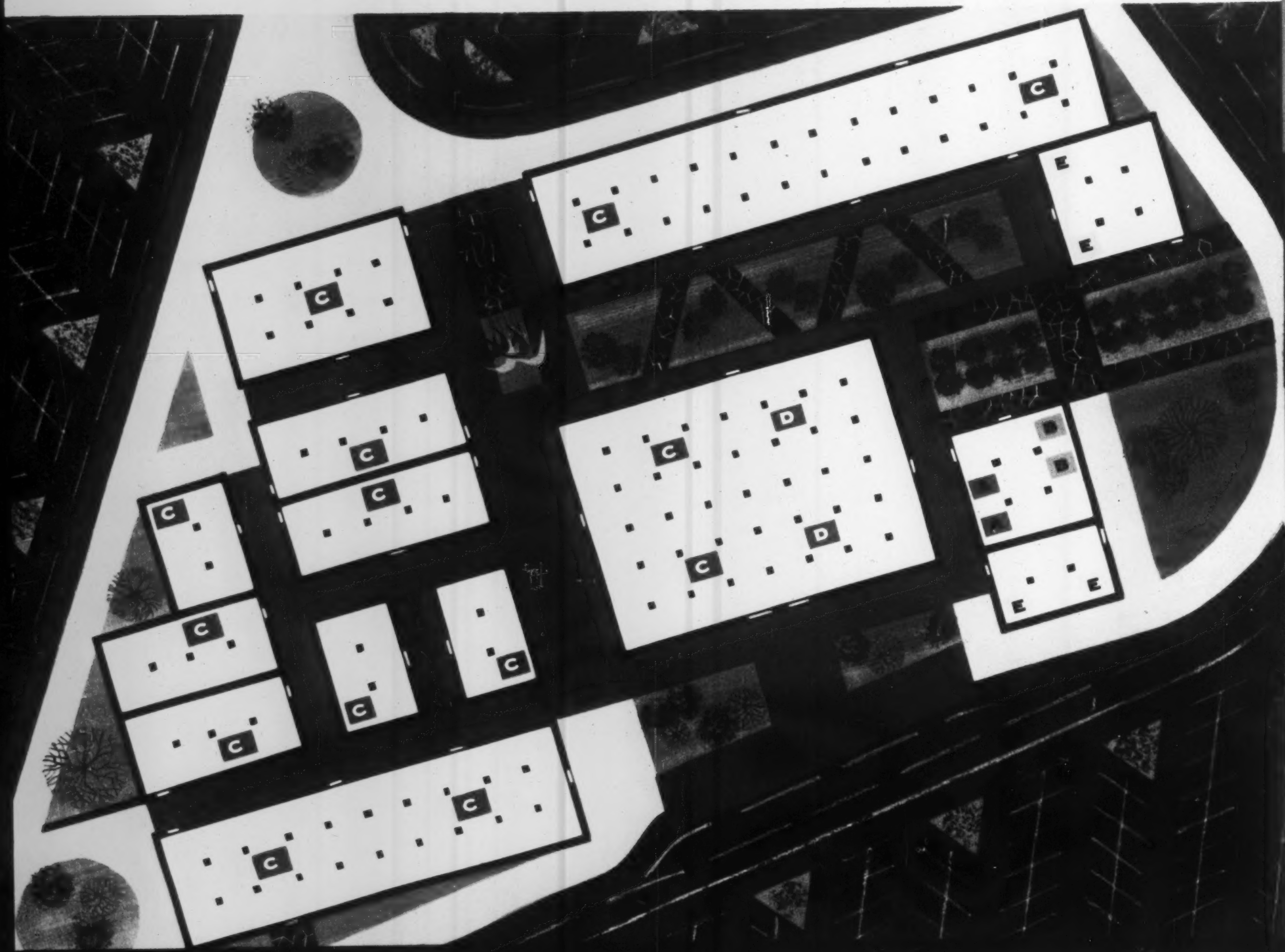
ucts designed / engineered / manufactured to work together

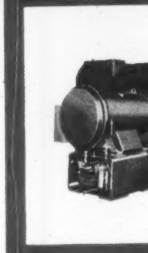
Air Conditioning	Centrifugal Refrigerating Machines • Central-Station Air Conditioners • Package Water Chillers • Room Fancoil Units • Induction Units • Multi-Zone Air Conditioners • Sprayed Coil Dehumidifiers • Air Washers • Cooling Coils • Self-Contained Air Conditioners Cooling Towers • High-Pressure Fans
Heating	Firebox, Scotch-Type, and Package Boilers • Steam, Hot-Water, and Gas-Fired Unit Heaters Heating and Ventilating Units • Heating Coils • Cabinet Heaters • Industrial Heaters
Ventilation	Centrifugal Fans • Propeller Fans • Axial Fans • Power Roof Ventilators • Utility Sets Specialized Fans and Blowers
Service-Water and Flow Control	Instantaneous Water Heaters for service-water, booster, or convertor duty • Gyrol® Fluid Drives to drive water-service pumps—eliminate compressed-air system or roof tank

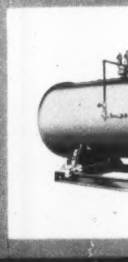
*American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation

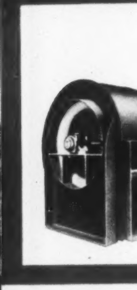


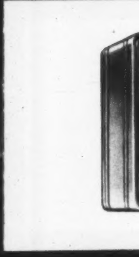
AMERICAN-STANDARD INDUSTRIAL DIVISION AIR-LIFT IN ACTION

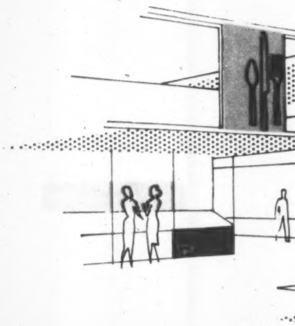


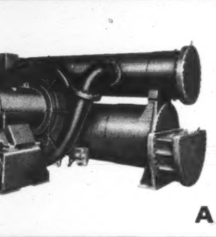












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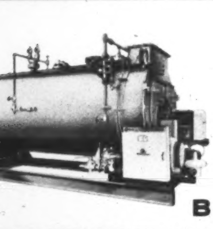

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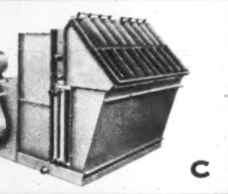

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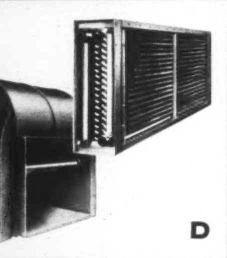

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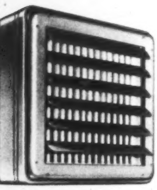

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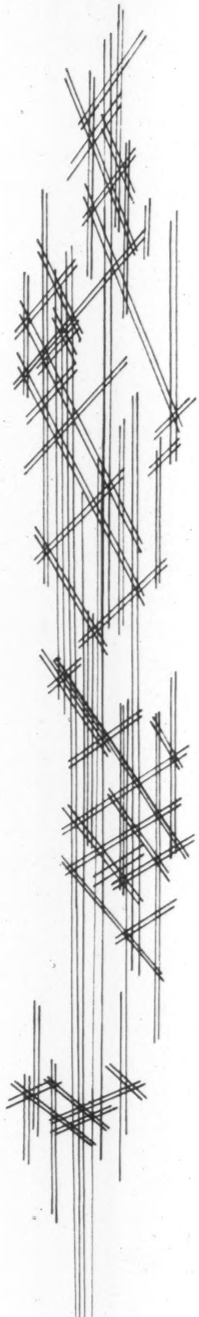
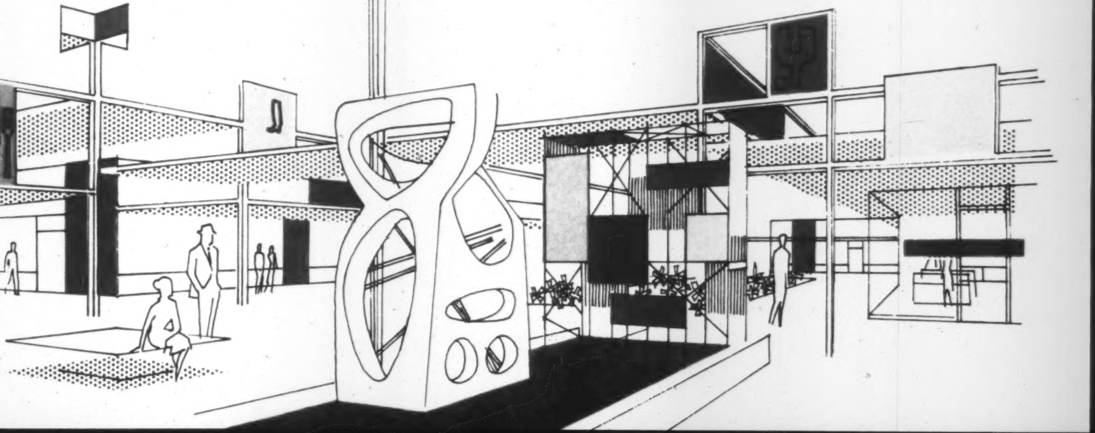
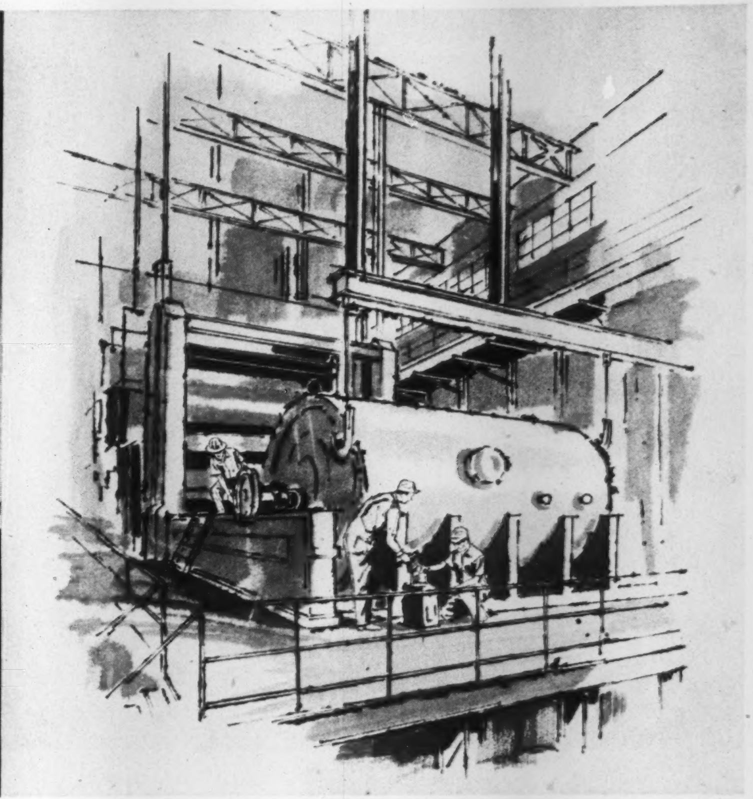


AIR CONDITION A CITY OF STORES WITH EQUIPMENT FROM A SINGLE SOURCE

You'd be surprised at the convenience—working with American-Standard Industrial Division from the planning stage on. You look to one company for your total requirements for air-conditioning systems of any size or degree of complexity . . . whether you need package units, multi-zone air conditioners, fans, or centrifugal refrigerating machines or boilers. You talk to product specialists who speak your language—know what their equipment can and can't do. Fewer interviews. Fewer call-backs. One source responsible for equipment quality, delivery dates, and service.





Put your best filter forward and watch your business grow!

Things start happening—*fast*—when you install your first PLIOTRON super-filter.

For it doesn't take a user long to discover that he's getting far cleaner air than ever before. After all, he's using a filter that traps up to *5 times as much of the "untrappable" fine dirt* as an ordinary filter.

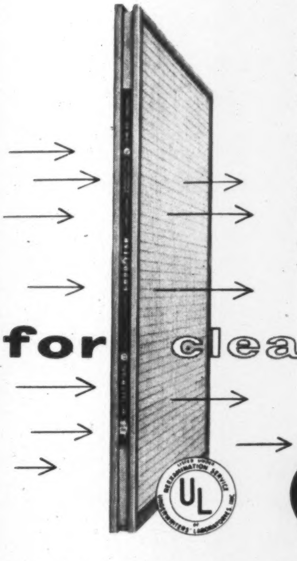
It's not long, either, before he's telling friends and associates about his great new filter "discovery"— and the installer who made it possible.

But it doesn't stop there. In a matter of months, your customer also finds out how much simpler PLIOTRON maintenance is. Instead of a messy, time-consuming re-oiling job, a simple vacuum cleaning or water-rinse restores full filter power.

In time, a PLIOTRON user also sees for himself that these filters aren't just called "permanent"— they *are* permanent. Properly maintained, they're good for the life of the heating or air conditioning system.

That means a PLIOTRON installation keeps advertising you and your business for years. Word gets around that you're the man to see for top-drawer products and services. And that's a reputation that pays off over and over again.

Remember, too — you can install the advanced PLIOTRON CR Filter in most commercial locations – or the new PLIOTRON HD Filter in the most critical industrial installations requiring heavy duty filtering. For complete details, write Goodyear, P.O. Box 52, Akron, Ohio.



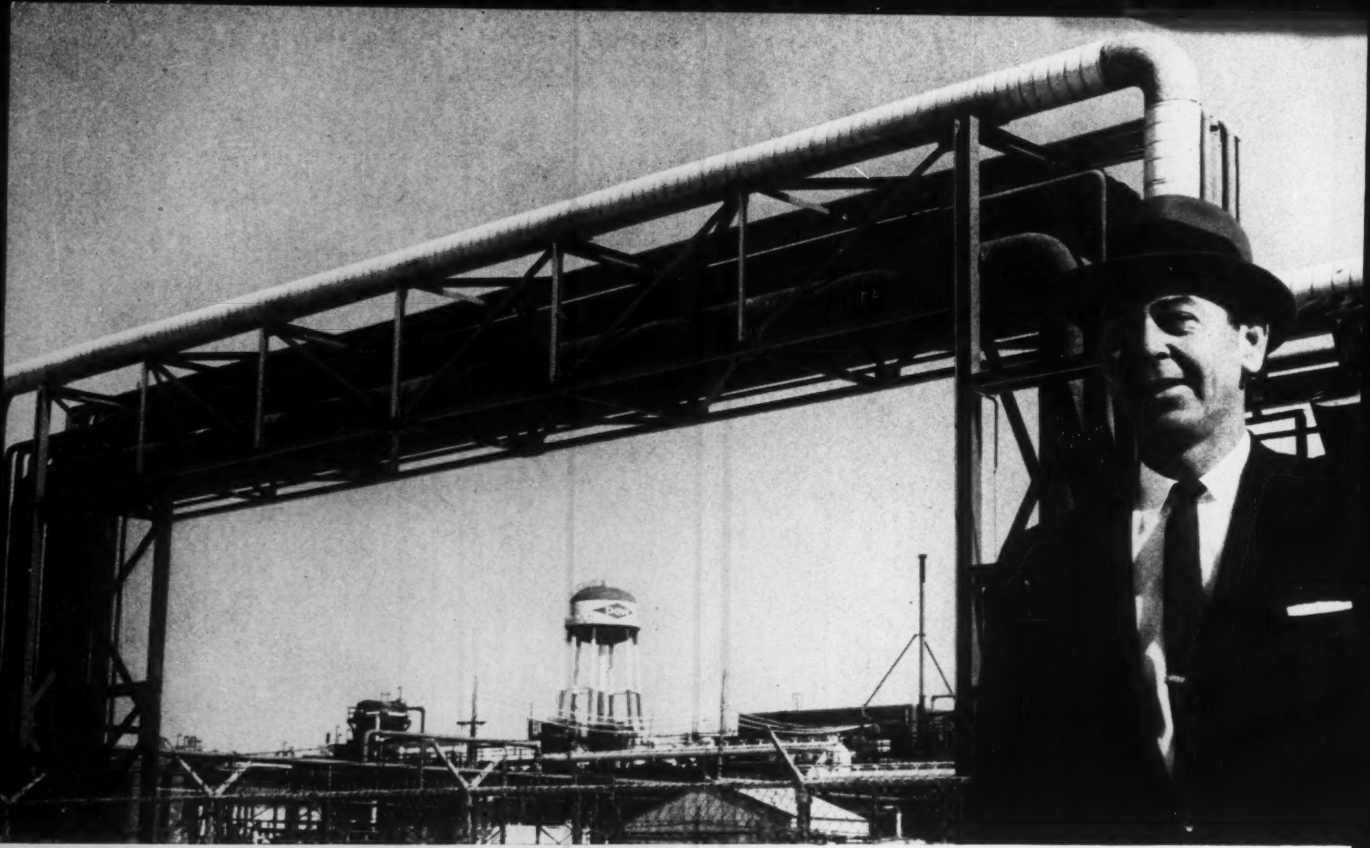
for cleaner air everywhere-

NEW PLIOTRON AIR FILTERS BY

GOODYEAR

THE GREATEST NAME IN RUBBER

Pliotron—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio



C. V. Harp, Houston, Texas District Office Manager, Reliance Electric and Engineering Company

“This new Duty Master goes three vital steps ahead in open motor protection.

“Right now the big story on open motors is encapsulation, for new protection against dust, dirt, acids, water and other contamination, indoors and out. The Reliance story adds something more.

“As step 1, read why Duty Master's ‘thixotropic’ process gives you better heat dissipation without cracking . . . in contrast to the thick, monolithic mold encapsulation now applied to other open motors. This is a definite design advance.

“As step 2, read about a new protective film coating of rotor and stator—to stop rust and ‘freezing’ in the air-gap. Another Reliance advantage.

“As step 3, get the story on complete shielding and water-repellent lubrication of bearings. Reliance design does the trick.

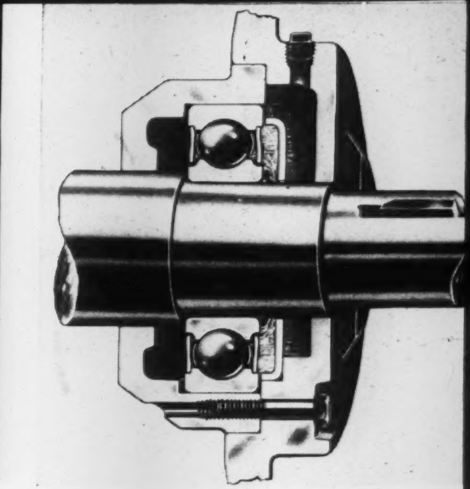
“The facts on the opposite page tell you all about Duty Master's complete open motor protection.

“You buy more than a motor when you buy this exceptional Duty Master.” B-1660-A

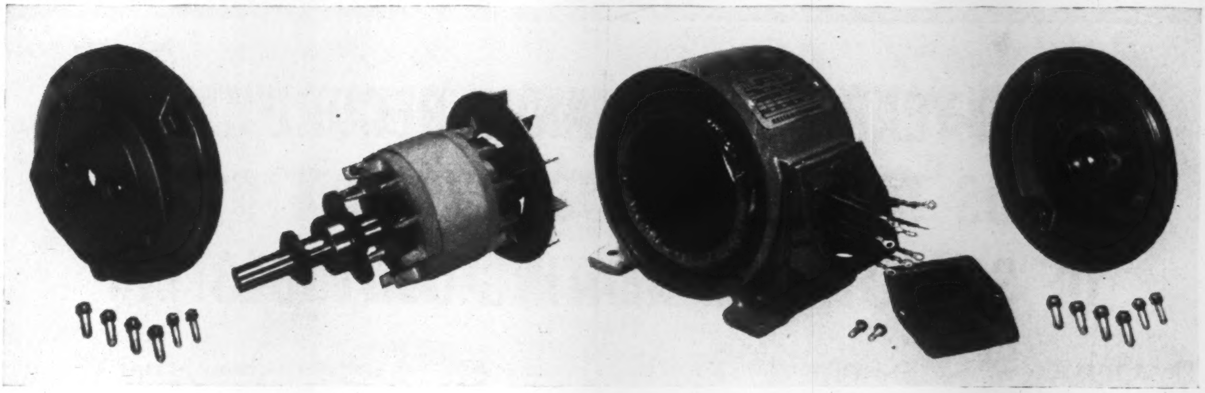
RELIANCE R Duty Master
A-C. MOTOR

Duty Master encapsulated windings are not in a molded, monolithic block as many motors are. The epoxy resin is vacuum impregnated into the windings, penetrating completely and forming a solid mass following the contour of the windings at a uniform thickness of ⅛ inch. Better cooling results because there is no bulky mold to inhibit dissipation of heat; further the epoxy supports the expansion of copper and iron without cracking. Method provides maximum flexibility, tensile strength, bond strength and still maintains resistive strength.

On these applications, the air gap between stator and rotor is a highly vulnerable area . . . consequently we took steps to prevent problems which would impair operation of the motor. Reliance devised a protective film to coat rotor and stator laminations and to remove the possibility of rust or 'freezing.' This film stays put . . . water, dust, dirt, or acid won't affect it . . . and it marks another step in over-all open motor protection. Downtime and maintenance costs are cut.



Bearings are double shielded—a slinger on the outside and a moisture-resistant inner cap keeps out water and other contaminants. Bearings are also prepacked in a special non-washing grease, which not only prevents rust, but will not wash out. Reliance's exclusive "Metermatic" lubrication system automatically meters correct amounts of grease to bearings from a large reservoir, and as the diagram shows, puts grease on *both sides* of the bearing.



Cast iron conduit box is threaded . . . has neoprene gasket providing a liquid-proof seal. Leads are individually held by molded pressure knobs numbered to correspond with wiring diagram. Box may be rotated to suit customer's convenience.

All motor bolts are zinc plated, hex-head . . . resist corrosion and assure positive wrench grip. Contact edges of end shields are greased to assure a completely tight seal.

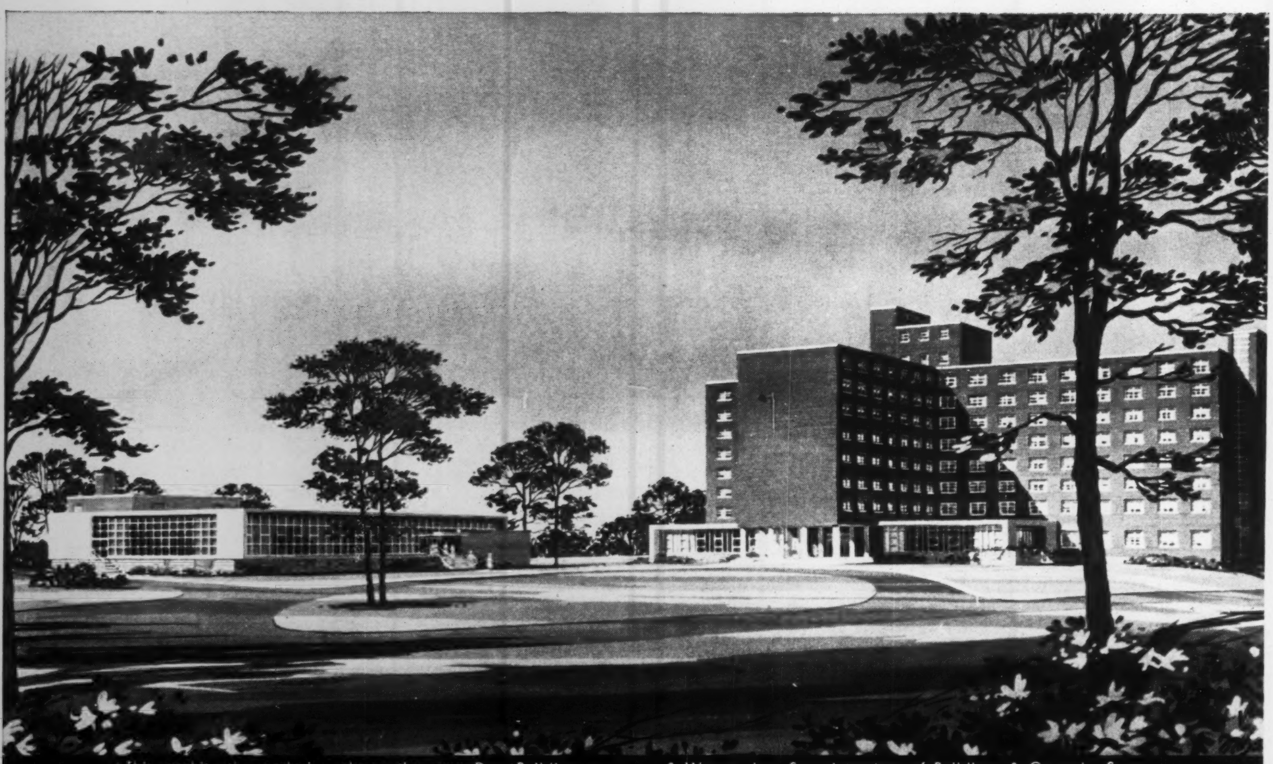
Your Reliance Sales Engineer has all the details. Get in touch with him at the nearest office, or write us for Bulletin B-2108.

Product of the combined resources of Reliance Electric and Engineering Company and its Master and Reeves Divisions

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 366A, CLEVELAND 17, OHIO
Canadian Division: Toronto, Ontario
Sales Offices and Distributors in Principal Cities

Duty Master A-c. Motors, Master Gearmotors, Reeves Drives, V★S Drives, Super 'T' D-c. Motors, Generators, Controls and Engineered Drive Systems.



This architect's rendering shows the new Day Building on Mt. Olympus, Syracuse University. Economical heating comfort is maintained in this, and two other new Syracuse dormitory multi-zone units controlled by Sarcotherm hot water control systems. Architects: King & King, Syracuse. Engineers: Robson & Woese, Inc. Superintendent of Buildings & Grounds, Syracuse University: E. J. Gibbons. Mechanical Contractors: (on the Day Building, above, and Sadler Hall) Edward Joy Company, Syracuse, N. Y.; (on the women's dormitory) Mechanical Installations Inc., Ozone Park, N. Y.

FOUR-YEAR PERFORMANCE RECORD LEADS TO 15-ZONE INSTALLATION OF SARCOTHERM HEATING CONTROLS

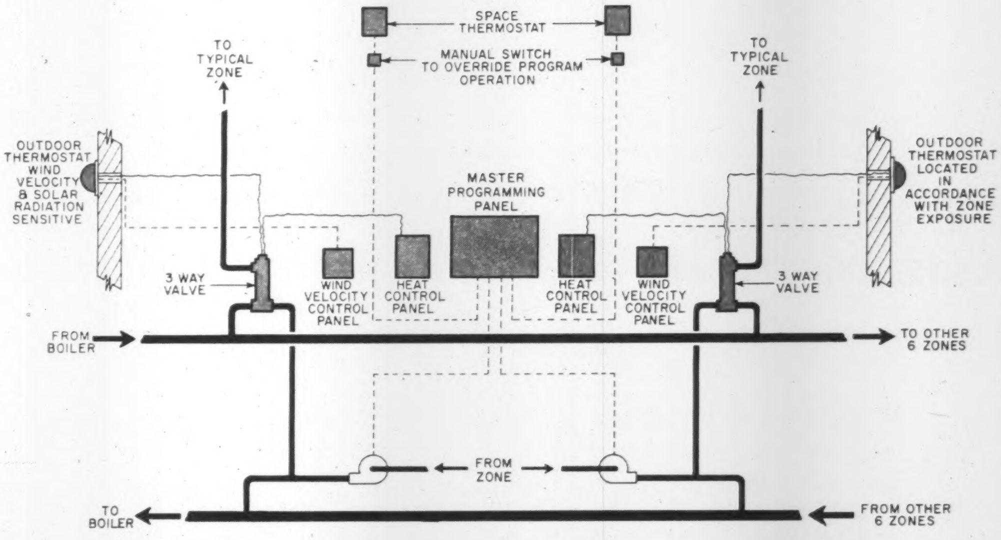
In 1956 Syracuse University installed a Sarcotherm hot water heating control system in an 8-zone dormitory project. Now four years of flawless operation have demonstrated the ability of the Sarcotherm system to deliver complete control of heating comfort — without any maintenance or repair of any kind. As a result, two new Syracuse dormitories have been built with Sarcotherm systems for a total of 15 zones Sarcotherm-regulated.

In each zone, Sarcotherm provides precise temperature control, fully allowing for occupancy and exposure, obviating the need for costly individual room control. The Sarcotherm system features a three-way valve controlled by an outdoor thermostat, which is highly responsive to temperature changes, solar radiation and wind load. In addition to this method of anticipating weather before it makes its effect felt indoors, the Sarcotherm system utilizes a master indoor control in each zone, which starts to cool the system as correct temperature is being reached.

This absolutely prevents overheating and prevents wasting fuel. All controls are sealed and are tamper-proof.

SARCOTHERM CONTROLS

Sarcotherm Controls, Inc., an affiliate of Sarco Company, Inc.
635 Madison Avenue, New York 22, N. Y. • Plant: Bethlehem, Pa.


SPACE THERMOSTAT
MANUAL SWITCH TO OVERRIDE PROGRAM OPERATION
TO TYPICAL ZONE
TO TYPICAL ZONE
OUTDOOR THERMOSTAT WIND VELOCITY & SOLAR RADIATION SENSITIVE
MASTER PROGRAMMING PANEL
OUTDOOR THERMOSTAT LOCATED IN ACCORDANCE WITH ZONE EXPOSURE
3 WAY VALVE
WIND VELOCITY CONTROL PANEL
HEAT CONTROL PANEL
HEAT CONTROL PANEL
WIND VELOCITY CONTROL PANEL
3 WAY VALVE
FROM BOILER
TO OTHER 6 ZONES
FROM ZONE
TO BOILER
FROM OTHER 6 ZONES

Typical schematic hook-up of the Sarcotherm Heating Control System at Mt. Olympus, Syracuse University. Diagram illustrates only two of the fifteen zones at Mount Olympus.

. . . AND BASIC SIMPLICITY OF RUGGED SARCOTHERM CONTROLS SPEEDED INSTALLATION AND ADJUSTMENT

Fewer parts and uncomplicated wiring greatly simplify Sarcotherm installations. In addition, Sarcotherm unit-packed and tagged every component, prepared complete working drawings, and keyed all parts of these drawings. This substantially reduced installation time. On-the-job cooperation by trained Sarcotherm personnel contributed to the speed and efficiency of the work.

Sarcotherm personnel always make final adjustments and take the system through start-up. Sarcotherm provides complete operating manuals and gives personal instruction to all operating personnel.

In these three modern dormitories, Syracuse University has a control system free of maintenance problems. All of these projects profited from the simplicity of Sarcotherm design and the thoroughness of the installation methods, developed through more than 20 years of specialized experience.

1331

✻ *FOR COMPLETE CONTROL SYSTEM CATALOG* write Sarcotherm Controls, Inc., 635 Madison Ave., New York 22, N. Y.

SARCOTHERM CONTROLS

Sarcotherm Controls, Inc., an affiliate of Sarco Company, Inc.
635 Madison Avenue, New York 22, N. Y. • Plant: Bethlehem, Pa.

PERMA-LAP® FRAMED MODINE CONVECTORS
EASIEST TO INSTALL, EASIEST ON THE WALL

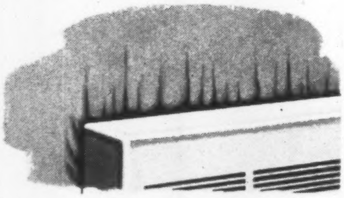
PERMA-LAP framing assures a neat, permanent, recessed installation . . . units can be serviced without disturbing wall seal

Modine's PERMA-LAP framing ends all the problems common to recessed convectors of conventional design. With PERMA-LAP, Modine convectors install fast and clean . . . whether walls are smooth or rough. PERMA-LAP neatly frames the unit in the recess . . . snugs up to finished walls or can be plastered in. No chance for air leakage and resulting wall streaking.

Once Modine convectors are installed, walls are never disturbed. Servicing? Nothing to it! Machine screws permit rapid removal and replacement of the lighter-weight, smaller front panel . . . eliminate need for access doors.

Cost more? Yes, slightly more than conventional recessed convectors. But they actually save more than the difference in lower installation and redecorating costs.

PERMA-LAP is available for flush recessing and in 2⅜", 4⅜" and 6⅜" projections to permit partial recessing of convectors in walls of varying thicknesses. Modine's line of recessed cabinet units is also available with PERMA-LAP framing. For complete details, mail the coupon below. Or contact your Modine representative . . . he's listed in the yellow pages.



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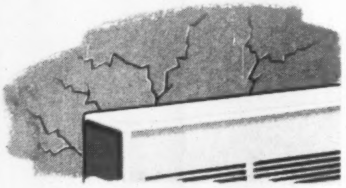
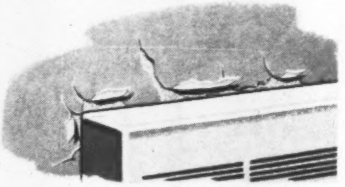
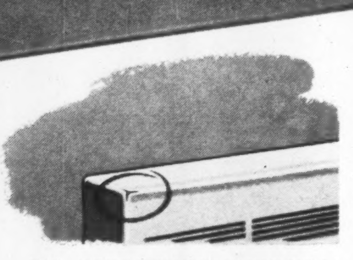


NO CRACKED PLASTER!



NO PEELED WALLPAPER!



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Modine®
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MODINE MANUFACTURING COMPANY
1509 DeKoven Ave., Racine, Wisconsin
I would like complete PERMA-LAP details. Please send Convector Bulletin 259 and Cabinet Unit Catalog 557.

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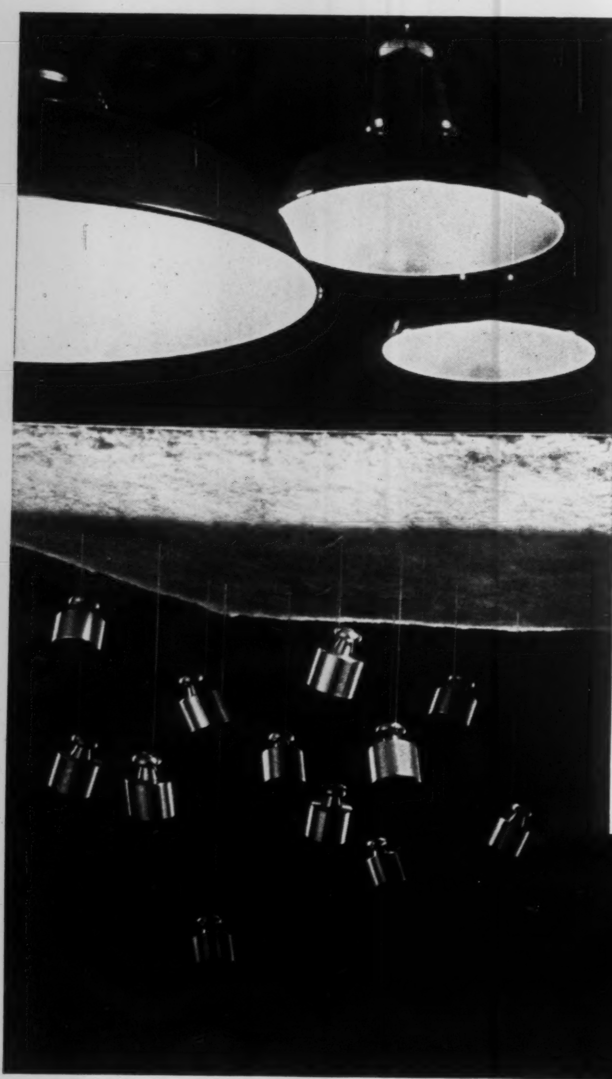
In Canada: Sarco Canada, Ltd., Toronto 8, Ontario

3M Brand Adhesives and Sealers answer these insulation needs...



HIGH HEAT RESISTANCE. Rugged Adhesive EC-1128 holds tight despite temperatures as high as +300° F. And it resists moisture so that steam can't loosen the bond! Even when temperatures drop to −20° F, it still holds insulation to the duct. What's more, EC-1128 provides instant grip . . . yet plenty of open time to let you position the insulation without rushing. With EC-1128 you can also bond lapped foil-to-foil seams to keep insulation dry for top performance.

FLEXIBILITY. Resilient Sealer EC-800 stays rubbery, flexes with duct expansion and contraction. It's ideal for high velocity systems! Sets up firmly at duct joints; won't flow out of seams under pressure. Apply EC-800 with brush, flow gun or putty knife. Once dry, EC-800 forms a tight seal that actually adds structural strength to duct work.

SEE WHAT 3M ADHESIVES CAN DO FOR YOU. Contact your 3M Field Engineer. Or, for more information and free literature telling how time-tested 3M Brand Adhesives and Sealers can help to solve virtually all your insulation installation problems, write on your company letterhead to: A. C. & S. Division, 3M, Dept. SBI-60, 900 Bush Avenue, St. Paul 6, Minnesota.

ADHESIVES, COATINGS AND SEALERS DIVISION

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THE PREMIUM QUALITY REFRIGERANTS
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New "Zephyr" Containers for "Freon" Designed for Your Convenience

- Built-in carrying handle
- Can be used upright or inverted
- Can be stacked
- New handwheel valve
- Lighter in weight
- New 50 lb. size

These new "Zephyr" containers can be used either upright or inverted without special blocks or stands. A permanent collar protects the valve and serves as a built-in carrying handle. These are the only refrigerant containers that can be stacked one on top of the other. They are shorter—lighter—easier to carry. A 50 lb. size is now practical. No wrenches are needed because these new containers also have a new type handwheel valve. They will stand upright in your truck.

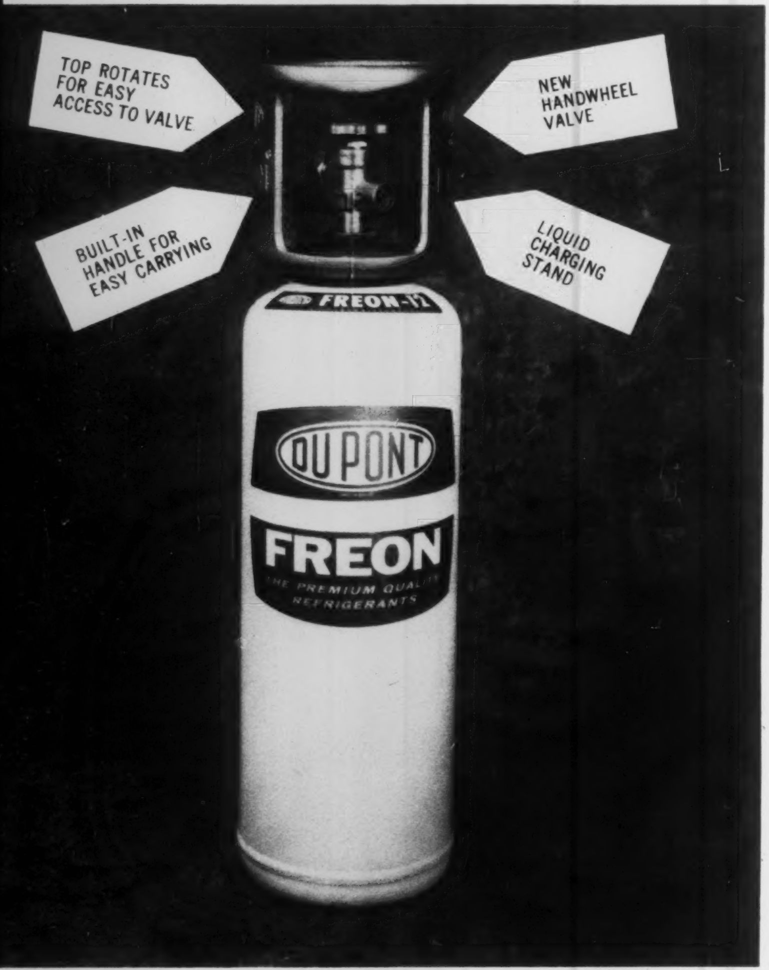
"Freon-12" and "Freon-22"—the premium quality refrigerants—are now available in these new "Zephyr" containers in 25 and 50 lb. sizes from your *leading* air conditioning and refrigeration wholesalers. Place your order for "Zephyr" containers today.

Please turn page for another announcement ▶

NEW TOP *and* VALVE

are being added for your convenience

to Standard 25 lb. cylinders for "Freon"


TOP ROTATES FOR EASY ACCESS TO VALVE
NEW HANDWHEEL VALVE
BUILT-IN HANDLE FOR EASY CARRYING
LIQUID CHARGING STAND
FREON-12
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THE PREMIUM QUALITY REFRIGERANTS

This new "Spintop" cylinder is now available in addition to the Standard 25 lb. cylinder with hood cap. The "Spintop" is a convenient carrying handle, valve protector and stand. Being free to rotate, it provides easy access to the valve. The regular valve has been replaced with a convenient handwheel type that includes a special spring-loaded pressure relief device for added safety.

Now—a Container for Every Use

For your convenience "Freon" refrigerants are offered in a family of containers*. Each of these types of containers has its own distinctive advantages. The container that best suits your needs is available from your leading air conditioning and refrigeration wholesaler. Call him today for your order of "Freon" refrigerants.

**1 or 2 lb. "Can-O-Gas" containers of "Freon" refrigerants are available from the Virginia Smelting Co., our nationwide sales agent and authorized repackager.*

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"Zephyr"-25
"Zephyr"-50
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premium quality

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you'll want to know...

MCAA Adopts National Policy Statement, Amends Constitution and By-Laws at Convention

AT THE 71st annual convention of the Mechanical Contractors Association of America last month in New York City, a statement of national policy regarding the functions of the organization and its members was adopted. It included such subjects as relations with architects and engineers, with general contractors, with suppliers, with labor, government agencies, and with local associations. Of particular interest are the paragraphs devoted to the relations with architects and engineers that are quoted below:

"Architects and engineers should provide, free of charge, sufficient plans and specifications to all bidders and allow ample time for bidders to prepare an intelligent bid. Drawings and specifications should clearly define the work to be done.

"MCAA believes that responsibility at each level of the construction industry is essential. The use of all-inclusive clauses and unfair requirements by architects and engineers is an unwarranted attempt by architects and engineers to pass their responsibilities on to the contractors and this practice should be abolished.

"Plans and specifications are the sole responsibility of the architects and engineers. The responsibility of the mechanical contractor is to install the work in accordance with such plans and specifications and the only guarantee which should be required of a mechanical contractor is one covering workmanship and material.

"Bidding on installations which are not designed and where the mechanical contractor is required to design and offer a firm proposal in competition with other contractors should be discouraged. This practice involves a great effort on the part of a number of people, is basically not economical in concept, and constitutes unfair competition with architects and engineers.

"Contractors should assist architects, engineers and owners by advising them, when requested, on relative costs of alternates while plans are being prepared so as to reduce the number of alternates.

"The mechanical contractor should include the furnishing of *all* mechanical equipment and material necessary for a complete system. The practice of the owner or architect-engineer buying materials or equipment to be installed by the mechanical contractor is not only uneconomical but leads to confusion, delays and waste and encourages the practice of labor lumping which endangers good labor relations.

"The requirement for bidding on unit prices is unintelligent and unfair since the cost of installing mechanical work is subject to many variables and is not able to be computed on a per foot or per fitting basis. All change estimates should be quoted on the basis of conditions affecting that particular work.

"Specifications requiring the overlapping of trades are an unfair condition and architects and/or engineers should make every effort to include work in the individual sections of the specifications in line with jurisdictional practice.

"MCAA recommends the quick return of certified checks on all public work, especially of those contractors who are not seriously considered further after the bids have been opened.

"In order to assure that the best interests of owner, architect, engineer and mechanical contractor are served, a joint committee should be maintained on relations between architects, engineers and mechanical contractors."

Several amendments to the constitution and by-laws were also approved at the convention. The changes mainly involve terminology with reference to the heating, piping, air conditioning, and refrigeration industry and to the offices held by members of the association. For instance, one of the objects of the association is now given as:

"To develop the mechanical contracting business, including the heating, piping, air-conditioning, and refrigeration contracting industry and to promote the interests and welfare of its members."

The newly worded scope now is as follows:

"The heating, piping, air-conditioning, and refrigeration contracting industry is understood to mean the individuals, firms and corporations who contract to furnish and install piping and piping systems of all kinds and appurtenances thereto, and includes all systems of heating, cooling, ventilating, refrigeration, air conditioning, power piping, industrial and process piping, sprinkler piping (other than for fire protection), temperature control piping, high and low pressure boilers, stokers, oil burning equipment, gas burning equipment, pneumatic and hydraulic piping, and insulation, painting, and sheet metal work as required by such installations."

Another change involved the naming of the officers who will now be known as the president, senior vice president and treasurer and who will be elected from the membership of the association. The duties of the former secretary will now be handled by an executive vice president. An additional office of secretary with additional duties has been created. Other changes included the number and terms of members elected to serve on the Board of Directors.

Newly elected officers at the convention for 1960-61 were:

President, Joseph S. Kearney, Evanston, Ill.

Senior Vice President, Frank V. McBride, Paterson, N.J.

Treasurer, Leon L. Munier, New York, N.Y.

The following directors were elected to serve for three years:

Grant J. Hayes, Indianapolis; W. A. Landers, Oklahoma City; E. B. Lent, Bremerton, Wash.; Frank A. Player, Atlanta; Walter C. Schukai, St. Louis; A. C. Lederer, Houston; and Frank Hess, Los Angeles, elected for two years to complete the term of William B. Scott, Jr., outgoing president who under the revised constitution and by-laws is precluded from service on the board subsequent to his term as president.

The next convention will be held in Miami Beach, Florida in May, 1961.

MCAA OFFICERS for 1960-61 are (l to r) L. L. Munier, treasurer; F. V. McBride, senior vice president; J. S. Kearney, president. At far right is W. P. Scott Jr., outgoing president

Congressmen Hear C. E. C. President

Ralph M. Westcott, president of the Consulting Engineers Council, appeared recently before the Public Works Subcommittee of the United States Senate Appropriations Committee and before the corresponding House of Representatives subcommittee to present the Council's official position in favor of the use of consulting engineers on public works projects.

Mr. Westcott expressed the council's concern over last year's Report 424, which accompanied the Public Works Appropriations Bill for fiscal 1960, and which recommended that the government consider reducing the use of private engineering services. He pointed out that private engineers have been called upon twice in the last 20 years to furnish a reservoir of engineering strength during national emergencies. Issue was also taken with suggestions made recently toward the build-up of public engineering staffs. The C.E.C. president cited the inherent flexibility of manpower and ideas in private engineering firms, and pointed out that such advantages are not available in government staffs. He questioned the advisability of maintaining large public staffs in the light of comparative cost figures indicating a marked reduction in engineering expenditures when private firms were employed.

Mr. Westcott said that the apparent tendency towards the formation of public engineering groups might produce two serious consequences: the destruction of private engineering businesses as a segment of the free enterprise system, and greatly increased costs to the taxpayers.

Substantiating data were submitted with the president's formal statement, including recommendations on the extended use of private consultants made in the 1955 Hoover Commission report on government reorganization.

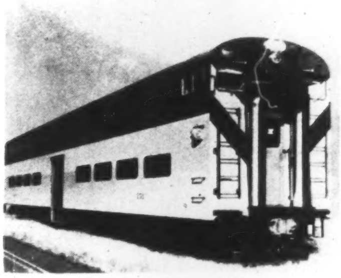
High Temperature Hot Water Heats New Industrial "Campus"

HIGH TEMPERATURE hot water has solved the problem of providing heating facilities for a nine building industrial complex covering 116 acres in Houston, Texas. The industrial campus is used by Southwestern Industrial Electronics Co., a division of Dresser Industries, Inc., for the production of special-purpose electronic instrumentation trailers and for the development of automated process control systems.

Two high temperature hot water packaged boilers, located in a central plant building within the complex, supply heating and process water to reheat coils in each of the buildings via underground piping. The water is delivered at temperatures ranging from 320 to 350 F, at 150 psi. Each of the boilers is capable of producing 6,700,000 Btu per hr, according to Cyclotherm Div., National-U.S. Radiator Corp. An electronic control system allows automatic operation of the plant, and can provide full power from a cold start in 15 to 20 minutes, reports Bill Hammond, SIE Facilities Director.

Even distribution of heating water is insured by a pressurized system using nitrogen gas for minimum corrosion. A vertical pressure tank is connected by a bottom valve to the main head tank. An increase in the volume of hot water causes an increase in the pressure of the nitrogen gas above the water, which opens a diaphragm controlled valve and allows water to pass to the head tank. A decrease in water volume within the pressure vessel activates pumps to transfer water back from the head tank.

Operating costs of the system, including those for nitrogen replacement and compressor operation, are said to compare favorably with estimated costs for a steam plant of similar capacity.



Commuter Cars To Be Air Conditioned

THE Chicago & Northwestern RR's 116 new bi-level commuter cars, now being delivered, are cooled by package air conditioning units, according to The Trane Co.

Each car will be equipped with two eight-ton cooling units, installed above the center entrance vestibule. The units will operate independently to cool one-half of the passenger space. Electric power for the system will be supplied from a power plant in the locomotive, resulting in considerable weight-saving for each car. Electric heaters for cold-weather use will be installed in the main air conditioning ducts, located at the center upper level and along each side of the lower level area. The upper and lower ducts will be served by a split evaporator coil.

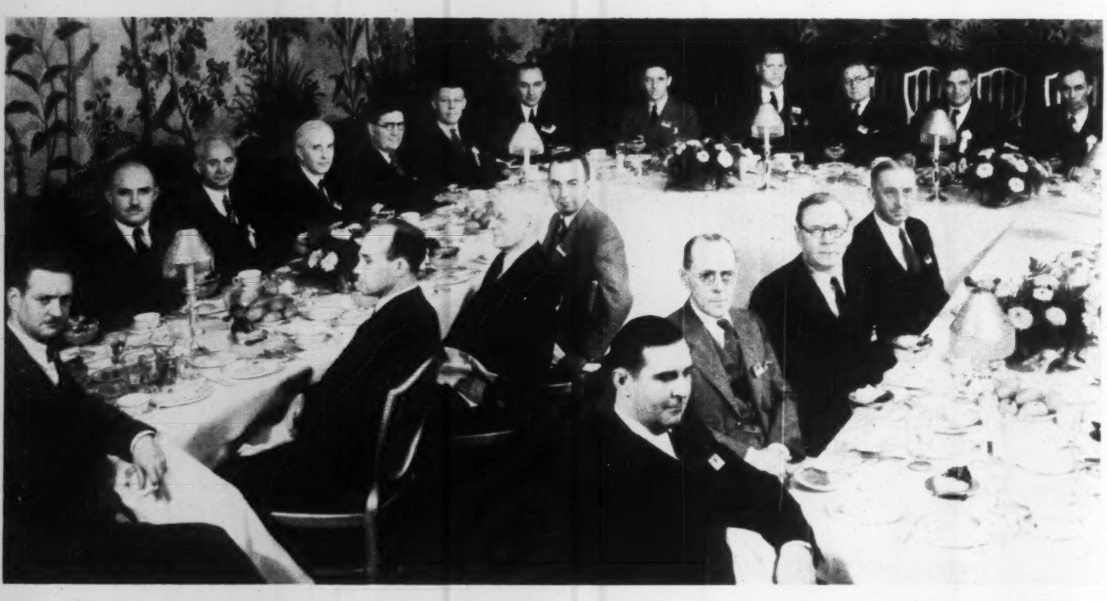
The new trains will use the "push-pull" principle. Diesel locomotives will remain on one end of the train, with control exercised from either the cab or "last" car.

Approve New Gas Water Heater Standard

THE American Standards Association has approved the new Requirements for Gas Water Heaters Volume I (Z21 101-1959) published by the American Gas Association.

The new standard covers the design, fabrication, and performance requirements of water heaters for fuel gases such as natural gas, manufactured and mixed gases, liquified petroleum gases, and LP gas-air mixtures.

The standard is available at $2.00 per copy from the American Standards Association, Department PR149, 10 E. 40th St., New York 16, N.Y.



This Lunch Meeting Was Held 28

WHILE clearing out some files, Professor A. P. Kratz of the University of Illinois came across this photo of a lunch meeting in Cleveland in January 1932, at which Heating, Piping & Air Conditioning's editorial department was host to several members of HPAC's board of consulting and contributing editors and other invited guests. Professor M. K. Fahnestock, who is now a member of this board, "liberated" the photo for HPAC's offices.

In addition to Professor Kratz, many other authorities well known in the field of heating, piping, and air conditioning attended the lunch. Samuel R. Lewis — author of the regular editorial feature "Sam Lewis' Page" — is in the center at the left of the photo. Three places to his left is Sabin Crocker. C. V. Haynes is on Mr. Lewis' right. Howard C. Murphy is at the right of the photo, next to him is R. E. Gould, and next is Professor Kratz. Professor Frank B. Rowley is at the right of the group at the head table.

Next to Professor Rowley is the late Dr. Willis H. Carrier, and at the left end of the head table is the late Walter L. Fleisher. Others in the photo include John Howatt (for many years chief engineer of the Chicago board of education), L. A. Harding, Homer Linn, John F. Hale, and D. S. Boyden. At

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Use Stainless Tubes In New Power Plant Condenser

A GIANT NEW power plant unit, now under construction for the Duquesne Light Co., Elrama, Pa., station, will include an 850,000 lb of steam per hr condenser which will contain 15,412 stainless steel tubes. Each tube is 30 ft long, with a 7/8 in. OD.

The choice of stainless steel tubing was dictated because the pH value of Monongahela River water, used as the condensing medium in the unit, drops as low as 3.5, according to Allegheny Ludlum Steel Corp. Approximately 90,000 gpm of river water is

Years Ago

least 10 of these pioneers in the industry served as president of the American Society of Heating and Ventilating Engineers, later the American Society of Heating and Air-Conditioning Engineers.

Wallace J. Osborn and Robert A. Jack, vice presidents of Keeney Publishing Co. (publisher of Heating, Piping & Air Conditioning), and Robert P. Wettstein, who represents HPAC in the West Coast states, are also in the picture.

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pumped through the condenser to absorb heat from steam which is discharged from the low pressure turbine. The high acidity of the river water causes rapid build-up of corrosive film on the outside of condenser tubes, and tends to retard the heat transfer efficiency of the unit. Cleaning of the tubes to remove the film exposes the bare tube metal to rapid acid attack.

The thin-wall stainless steel tubes being installed are said to provide approximately the same heat transfer ability when 85 percent clean as will thick-wall nonferrous types with all film removed.

Mechanical Contractor Survey Shows Lower Profit-to-Sales Ratio in 1959

THE RESULTS of the annual statistical survey conducted by the Mechanical Contractors Association were presented by A. L. Cherne of Minneapolis, chairman of the statistical survey committee, at the recent MCAA convention in New York City.

The survey form was sent to all MCAA members (about 1200) and a total of 248 complete replies were received. These were used in tabulating the results. One of the most significant items was that the average ratio of profit to sales before taxes had dropped from 2.56 percent in 1958 to 2.29 percent. This is an average figure taking into account a wide range of business operations in four classes of gross annual volume from up to $250,000 to over $2,500,000. Mr. Cherne observed that this decrease in the profit percentage apparently was an accurate reflection of the competitive and price conscious situation today. He also made the following comments along these lines:

"Profit is a must. There can be no employer or employee in any business that doesn't make money. There can be no growth for that business if a profit is not experienced. There can be no opportunity for the individual to achieve his personal ambitions unless the company makes money. Success does not just happen. It requires intelligent planning, for you get ahead by thinking ahead. Charles Kettering, who was, among other things, the father of the self-starter, once said:

'My interest is in the future because I am going to spend the rest of my life there.'

"I am sure that is where we intend to spend the rest of our lives but we cannot expect to be successful without intelligent planning.

"You and I know that this (heating, piping, and air conditioning) business is something like courting a girl — *'Some measure of romance and timing is essential to the receipt sprinkled and mixed with several important catalysts.'*

"Here are but a few of those ingredients:

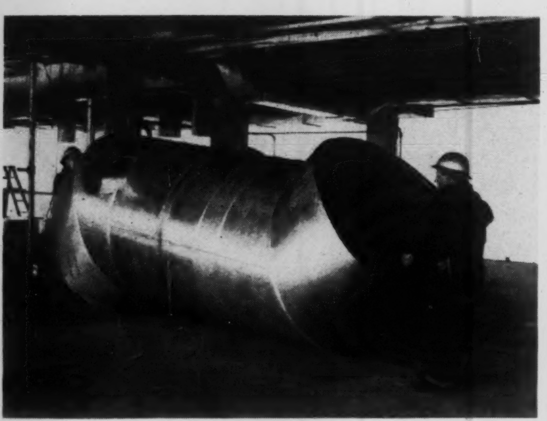
1) The first thing to do is fall in love with your work.

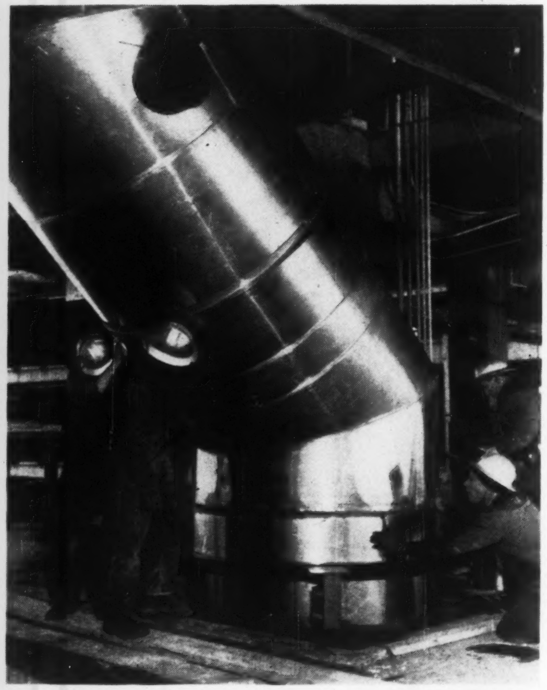
2) Prepare for the job, for the real essence of work is concentration, and every day gives you another chance.

3) Have the right attitude, determination, and enthusiasm to do a good job all the time.

"Dr. Karl Menninger made a profound observation and I would like to pass on what he had to say about attitudes. He said, 'Attitudes are more important than facts. Any fact facing us, however difficult, even seemingly hopeless, is not so important as our attitude toward that fact. How you think about a fact may defeat you before you ever do anything about it. You may permit a fact to overwhelm you mentally before you start to deal with it actually. On the other hand, a confident and optimistic thought pattern can modify or overcome the fact altogether. Tough competition, accumulation of difficulties, multiplication of everyday problems, lack of profits, all tend to sap energy and leave us spent and discouraged — in fact, perplexed with what is to come. In such a condition, the true status of our power is often obscured and a person yields to a discouragement that is not justified by the facts.' "

Another interesting result of the survey showed that the percentage of sales made in the category of heating and air conditioning increased while the volume of industrial piping business decreased in 1959. It was also noted that in 1959 there was an increase in preference for on-the-job, rather than shop, piping system fabrication.





SECTION of duct, above, more than 5 ft in diameter, has been fabricated in shop and moved to site in special wire cage. At right, end of section has been expanded 1-$3/4$ in. to ease task of making field joint

Contractor Invents Special Rigs To Make 5 Ft Diameter Air Ducts 28 Stories High

HUGE vertical air ducts, reaching from ground level to the top of the structure, have been installed in the new 28-story Kaiser Center building in Oakland, Calif.

The ducts are fabricated of aluminum sheets ranging in thickness from 0.025 to 0.050 in., and are supported by spring loaded hangers designed to distribute the load evenly under all conditions.

The largest of the ducts are 63 in. in diameter, and required special fabricating and joining techniques, according to the Scott Co., of Oakland, Calif. Two-arm jigs were devised for joining longitudinal and perimeter sections. An upper arm forms a track for a tungsten inert gas welding machine, while the bottom arm serves as a holding fixture. A copper strip was laid along the top of the steel pipe lower arm, and rolled sheet was then placed around the fixture with the open seam resting on the copper. The seams were joined by fusing at the rate of approximately 80 in. per minute.

Perimeter welding was accomplished by means of angle iron arms that extended to meet the sides of the duct. Three 4-ft sections were fused together in the shop, after which the larger sections were nested for shipment to the building site. A roller was used to stretch the ends of the 12-ft sections approximately 1$3/4$ in. to allow for a field joint. Adhesive cement and tape filled the joints, which were further strengthened by sheet metal screws. A special punch press rig was developed by the contractor to cut 4 in. diameter flexible tubing tie-ins in the ducts.

Air supplied via the giant ducts is used for ventilation and supplemental cooling, with a maximum temperature differential of about 15 F.

Approximately 300,000 lb of aluminum ductwork is used in the building, according to Kaiser Aluminum & Chemical Corp.

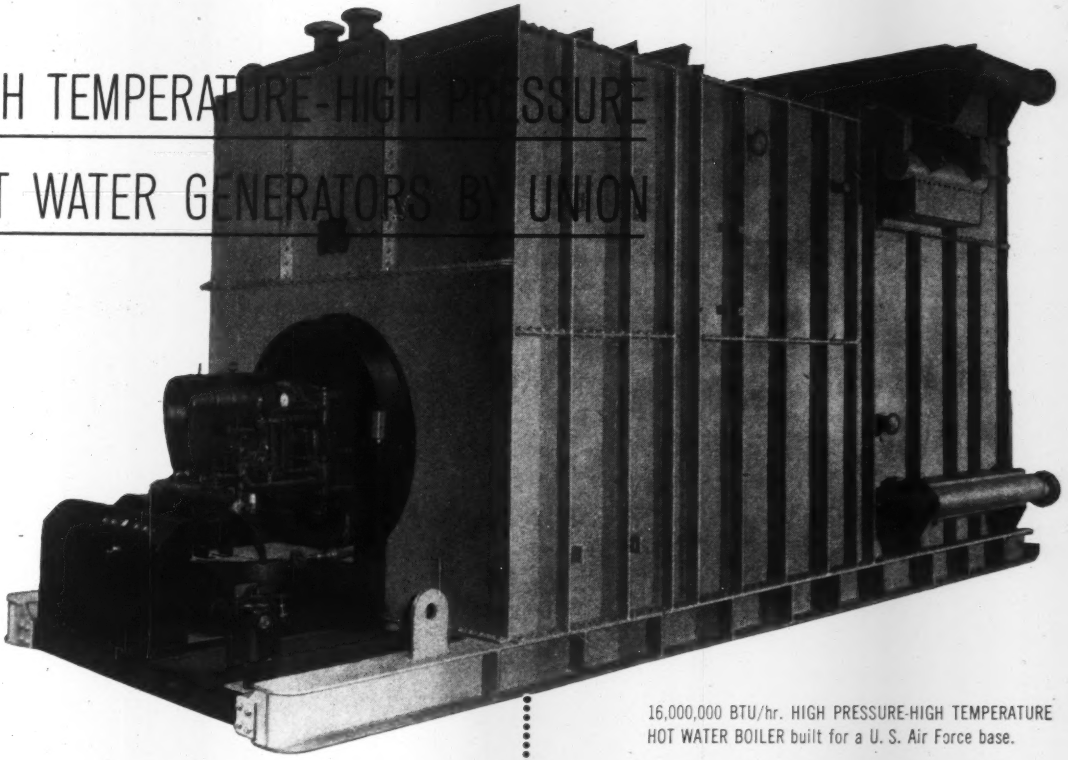
Approve New Gas Pipe-Appliance Standard

THE American Standards Association has announced approval of the revised American Standard Installation of Gas Appliances and Gas Piping (Z21.30-1959) published by the American Gas Association.

The new standard resulted from the cooperative efforts of the gas industry and 16 national groups, including manufacturing, professional, and trade associations and U.S. government interests.

The basic standards in the publication apply to the design, fabrication, installation, tests and operations of low pressure gas piping systems ($1/2$ psi or less) from the outlet of the meter set assembly or service regulator to the appliance inlet connection, plus the operation and installation of gas appliances supplied through such systems. It does not cover production process piping, treated in the Code for Pressure Piping.

HIGH TEMPERATURE-HIGH PRESSURE HOT WATER GENERATORS BY UNION



16,000,000 BTU/hr. HIGH PRESSURE-HIGH TEMPERATURE HOT WATER BOILER built for a U. S. Air Force base.

SHOP ASSEMBLED UNITS INSTALLED WITHOUT COSTLY FIELD BALANCING

Right from the start, you can save with a Union shop assembled **HTHP** Hot Water Generator. With all of its circuits of the same hydraulic length, time consuming field balancing can be eliminated. Most units do not require orifices or any other mechanical adjustments to equalize flow at the time of installation.

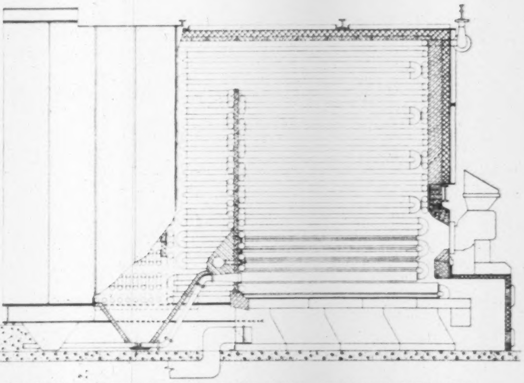
High water velocities (above 5 ft./sec.) and liberally proportioned, water cooled furnaces eliminate localized overheating. As there are no multi-tube circuits in the radiant section, recirculation within a circuit is impossible, thereby eliminating vapor binding or stagnant flow areas.

Liquid and gas flow run counter to each other. With the liquid inlet positioned at the top of the convection section, the lowest temperature liquid is served by the lowest temperature gas. As a result, generator efficiency is improved and the risk of thermal shock minimized.

Standard units (both shop assembled and field erected) can be modified to meet a wide range of job requirements. They can be arranged for firing with most commercial fuels as well as waste fuels in liquid, gaseous or solid form.

For specific information, outline your requirements to a Union representative or contact Union Iron Works.

UNION IRON WORKS • ERIE, PENNSYLVANIA



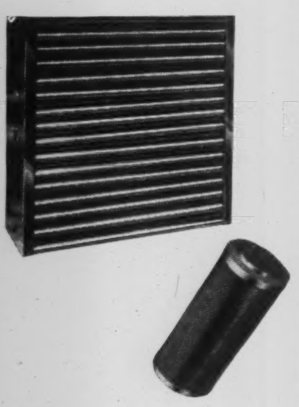
31,000,000 BTU/hr. FORCED CIRCULATION, HIGH PRESSURE-HIGH TEMPERATURE HOT WATER BOILER. Equipped for firing by an oscillating grate spreader stoker with fly ash reinjection. Fully factory-assembled for shipment.

UNION

water tube steam generators and allied equipment

HOW DOREX AIR RECOVERY annually cuts air conditioning costs by 78%

Over a 20-year period, the dollar difference is incredible, the penalties of owning and operating cost are tremendously reduced . . . if an air conditioning system uses DOREX to recover already conditioned air rather than use 100% outside air.



DOREX is designed in two basic types—C Cells and H Canisters. Because of their arrangement flexibility, canisters are especially suitable where installation space is limited or irregular.

ESTIMATED DIFFERENTIAL OF OWNING AND OPERATING COSTS, OUTDOOR AIR vs RECOVERY AIR FOR 1000 CFM

ITEM	ANNUAL FIXED CHARGES	OUTDOOR AIR	RECOVERY AIR
1.	Amortization, 20 years, cost per year	$ 78.10	$ 17.50
2.	Interest rate, 4 percent [(20 yr + 1)/(2 × 20 yr)] × 0.04 × initial cost	32.00	7.35
3.	Taxes and insurance (neglected)	0.00	0.00
4.	Total annual fixed charges	110.10	24.85
	ANNUAL MAINTENANCE COSTS		
5.	Repairs, refrigerating equipment $1.20 per ton	4.56	
6.	Refrigerant 0.44 per ton	1.67	
7.	Oil and grease 0.12 per ton	0.46	
8.	Repairs, heating gross	5.00	
		11.69	
	ANNUAL SERVICE COSTS		
9.	Electric power, refrigeration (0.746 × hp × cooling hours)e* = 3220 kwhr		
10.	Cost of electric power 1.5¢ per kwhr		
11.	Refrigeration power costs (Items 9 and 10)	48.20	
12.	Water at 11 cents per 1000 gal (neglected with cooling tower)		
13.	Heat requirement 4.5 × 1000 × 11.7** × 2200/e* = 165,000MBtu		
14.	Gas cost, $1.00 million Btu		
15.	Heating cost (Items 13 and 14)	165.00	
16.	Recovery fan power, 0.0001573 × 1000 head = 0.063 hp		
17.	Recovery fan power, [0.746(16) (2200 + 810)]/e = 188 kwhr		
18.	Recovery fan power costs (Items 10 and 17)		2.82
19.	Labor to change recovery cells		2.00
20.	Freight to ship used and recharged units		10.00
21.	Regenerate, recover cells		35.00
		213.20	49.82
	SUMMARY		
	Annual fixed charges	110.10	24.85
	Annual maintenance costs	11.69	
	Annual service costs	213.20	49.82
	Total annual owning and operating costs	334.00	74.67
	Annual savings with air recovery		260.32
		334.99	334.99

*Efficiencies are taken in items 9 and 13 as 70 and 75 percent respectively.

**Difference in enthalpy, Btu per lb of dry air, between inside and outside, for average winter conditions.

From a paper by Warren Viessman, Heating, Piping & Air Conditioning—Sept. 1959

By recovering used, already conditioned air, extracting from it the accumulated impurities, and converting it to original freshness, DOREX brings about maximum economy in air conditioning. Detailed information on the unique DOREX process and equipment is available. Simply request—on your letterhead, please—Bulletin 108A and "Air Conservation Engineering". Contact the representative near you or write to Connor direct.

CONNOR ENGINEERING CORPORATION

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ENGINEERING
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dorex®
air recovery

. . . the most experienced professionals in air recovery and purification.

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BUY A... **SIOUX** **ELECTRIC DRILL**

CERTIFIED SIOUX POWER

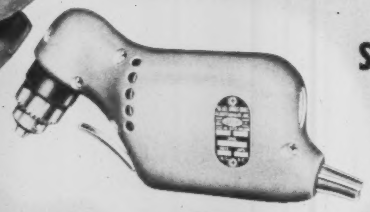
Electric Drills

When it's a SIOUX– you know what it will do!

The horsepower and torque for each Sioux electric drill is rated, stated, and certified. You are not expected to buy just a drill. When it's a Sioux you know what it will do. See complete power specifications for each Sioux Electric Drill in the Sioux catalog.

Super Powered 1/4″ & 3/8″ DRILLS!

Here is super torque for the toughest jobs. And a speed for every need. Entirely new design has placed the brushes at the fan position at the front of the drill. Advantages include easier inspection and replacement without disassembly of the tool, and cooler running. Catalog No.'s 1472,73,74 —¼″; No.'s 1477,78,79—⅜″.



SALES CHAMP

SIOUX No. 1495 1/4″ All Angle Drill

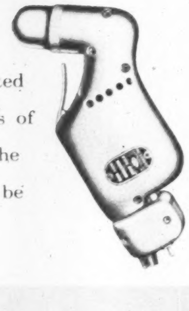
This exclusive Sioux design is a favorite of men who work with tools. It's the most convenient, rugged, fistful of power. It operates in restricted space where other drills can't be used. All around usefulness on the widest range of jobs make this sturdy, dependable No. 1495 one of the world's best drill buys.

SIOUX ELECTRIC SCREWDRIVERS

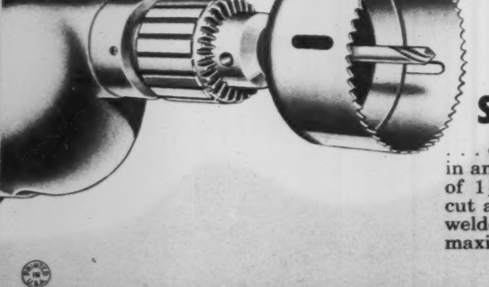
No. 260

On No. 260 Super Screwdriver, the operator controls the tightness with which a screw is set by the amount of pressure he applies. The ¼″ Hex Drive takes shanks for clutch head screwdriver bits, Reed and Prince, Standard screws, Phillips, and socket (Allen Type). On the No. 262 Super Screwdriver tightness is pre-determined by adjusting the clutch. Both models are equipped with reversing switch.

No. 242



It fits the hand, and operates in restricted space like no other electric screwdriver. It quickly drives or removes all types of screws. No. 242 has a positive clutch; the operator controls the tightness by the amount of pressure applied. No. 246 has an adjustable clutch, so that it can be preset for any uniform degree of tightness desired.



SIOUX *High Speed* STEEL HOLE SAWS

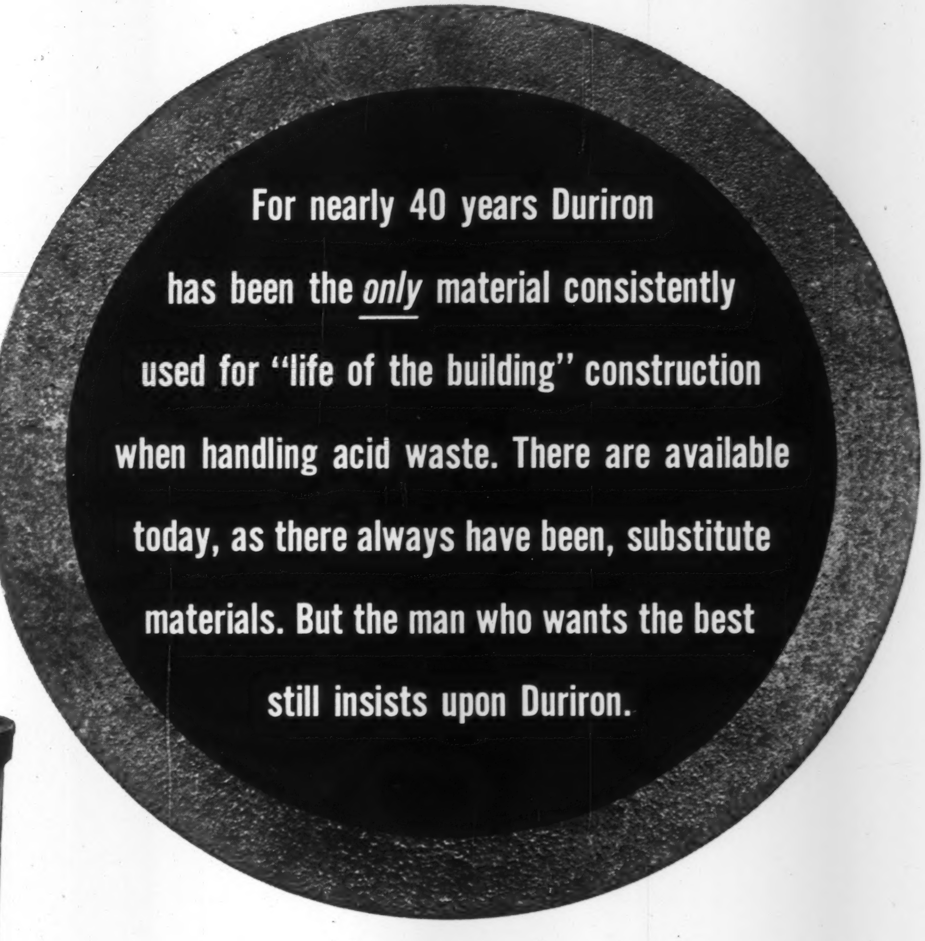
. . . cut holes from ⅝″ to 6″ in diameter, in any free machining material to a depth of 1⅛″. Alloy or stainless steel may be cut at slow speed. High-Speed steel teeth welded to chrome-vanadium body give maximum life and cutting ability.

Look Under **"TOOLS, ELECTRIC"**
in the Yellow Pages

ALBERTSON & CO., INC.
SIOUX CITY, IOWA, U. S. A.

- AIR IMPACT WRENCHES • AIR SCREWDRIVERS • ELECTRIC IMPACT WRENCHES • ELECTRIC SCREWDRIVERS • DRILLS • GRINDERS • SANDERS • POLISHERS • FLEXIBLE SHAFTS • PORTABLE SAWS • VALVE GRINDING MACHINES • ABRASIVE DISCS.

PROVEN BEST!
DURIRON PIPE
FOR CORROSIVE WASTE DISPOSAL



For nearly 40 years Duriron has been the *only* material consistently used for "life of the building" construction when handling acid waste. There are available today, as there always have been, substitute materials. But the man who wants the best still insists upon Duriron.

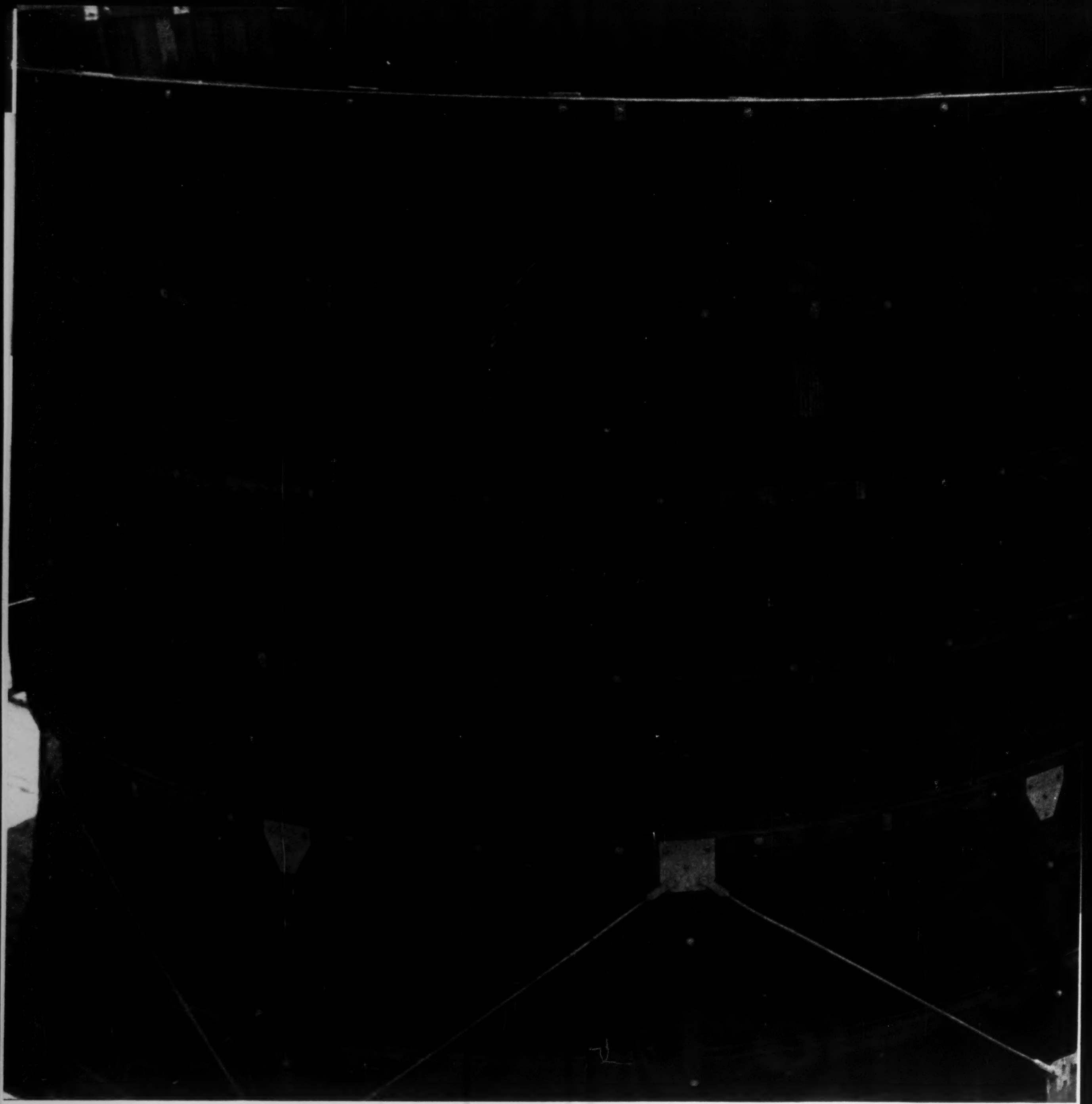
Install Duriron and forget it. Embed it in concrete, bury it in the ground, hide it behind walls and false ceilings, and forget it. Duriron is installed by standard plumbing methods. Available with a *complete* line of Duriron fittings.

The complete waste disposal system in Duriron will provide safety and ease of mind for the building owner and the specifications writer, as well as confidence and ease of handling for the plumbing contractor.

Insist upon the proven material—Duriron.

THE DURIRON COMPANY, INC. DAYTON, OHIO

DURIRON
LOOK FOR THE NAME ON EVERY PIECE



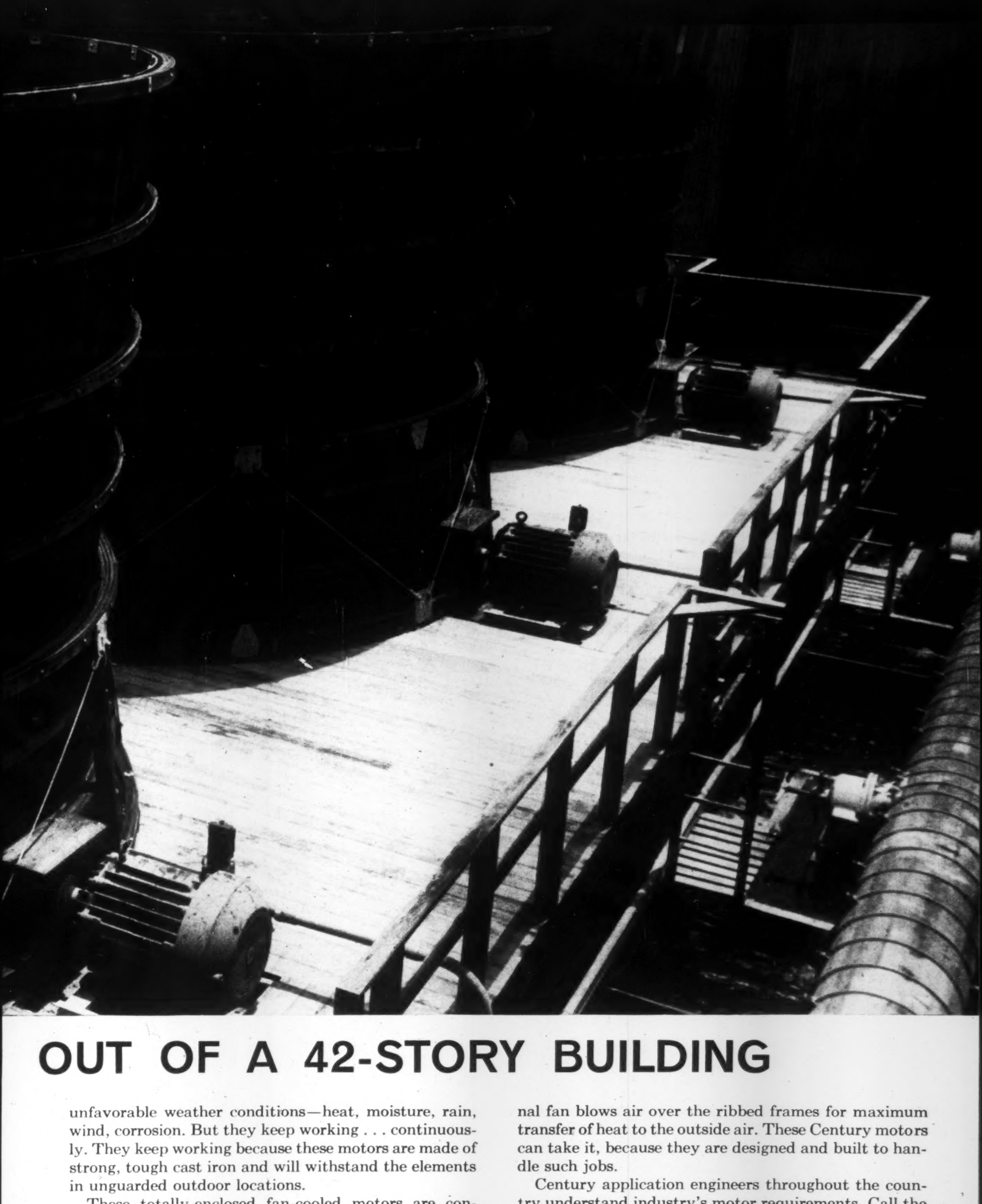
CENTURY MOTORS PULL HEAT

Forty-two stories above Dallas, on top of the South's tallest building, three Century 50 horsepower totally-enclosed fan-cooled motors are driving induced draft fans to keep the Southland Center cool.

A Century motor drives a 20-foot fan on each of three cells of this cooling tower. During the hot summer months, especially, the air conditioning of the immense Southland Center is dependent upon the continuous operation of these fans—and, upon the dependable, continuous operation of Century motors.

Heat absorbed by air-conditioning and refrigerating equipment must be removed efficiently. Maintaining efficient condensing temperature in a system of this large capacity, requires 20,000 gpm of cold water. And conservation of this gallonage with uniform performance at all times is necessary—the cooling tower is an important factor in the overall system.

Dependable Century motors are a vital part of installations such as this one where the continuous operation of the fans is so important. The three Century 50 horsepower, two-speed, totally-enclosed fan-cooled motors used in this installation are subject to all sorts of



OUT OF A 42-STORY BUILDING

unfavorable weather conditions—heat, moisture, rain, wind, corrosion. But they keep working . . . continuously. They keep working because these motors are made of strong, tough cast iron and will withstand the elements in unguarded outdoor locations.

These totally-enclosed fan-cooled motors are constructed so that no outside air (with dust, dirt, moisture, etc. in it) is circulated into the motors. Internal fans circulate *clean* air within the enclosed frames. An external fan blows air over the ribbed frames for maximum transfer of heat to the outside air. These Century motors can take it, because they are designed and built to handle such jobs.

Century application engineers throughout the country understand industry's motor requirements. Call the Century Office nearest you, or your Authorized Century Distributor for more information about Century's complete line of motors—from 1/20 to 400 horsepower.

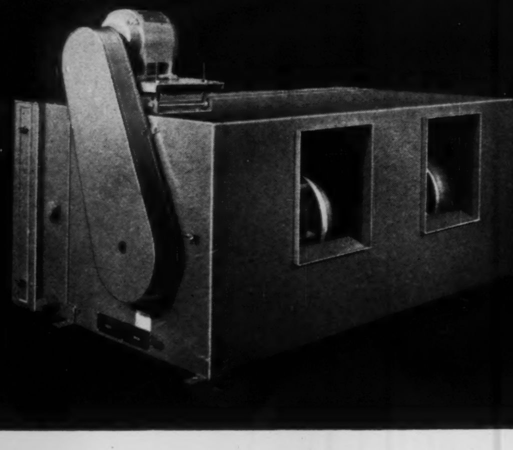
CENTURY ELECTRIC COMPANY Century

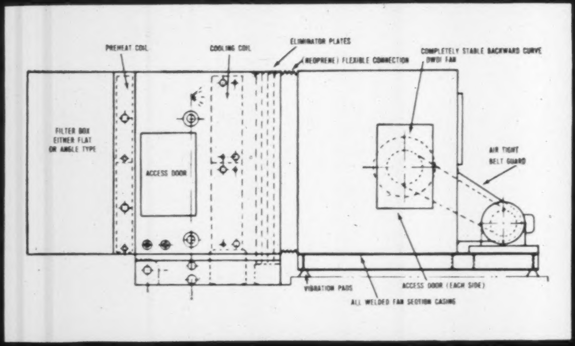
St. Louis 3, Missouri *Offices and Stock Points in Principal Cities* 59-24

WHICH OF THESE 'BUFFALO' BELONGS ON

For your largest central station air conditioning jobs 'Buffalo' PC Cabinets offer easy installation and minimum service. Fans are quality 'Buffalo' double-width, double-inlet type of lightweight, non-sparking aluminum. Oversize hollow shafts for vibrationless operation. Backward curved fan blades, plus streamlined housings, provide completely stable performance and limiting horsepower characteristic — no need to select an oversize motor. A heavy welded steel plate drip pan supports all functional elements. Casings are removable heavy-gauge panel, galvanized and factory primed. Write for Bulletin AC-121 for arrangements and sizes to meet any requirements.

Zone Control Air Conditioning At Its Finest. The same quality features of fan, housing, coil and casing built into Type PC Cabinets are present in 'Buffalo' Type PCB Zone Control Cabinets. The rugged tubular frame — easily assembled panels — handy access doors and outside bearings provide easy servicing. The quality Aerofin 45° pitched coils provide low headroom. And an exclusive 'Buffalo' feature is individual factory-sizing of damper zones for accurate proportioning of air flow. Write for Bulletin AC-220.




PREHEAT COIL
COOLING COIL
ELIMINATOR PLATES
(NEOPRENE) FLEXIBLE CONNECTION
COMPLETELY STABLE BACKWARD CURVE DWDI FAN
FILTER BOX EITHER FLAT OR ANGLE TYPE
ACCESS DOOR
AIR TIGHT BELT GUARD
VIBRATION PADS
ACCESS DOOR (EACH SIDE)
ALL WELDED FAN SECTION CASING

Your 'Buffalo' Engineering Representative will be happy to supply you with information

"Buffalo"

BUFFALO

BUFFALO,

Buffalo Pumps Division, Buffalo, New York

Buffalo Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

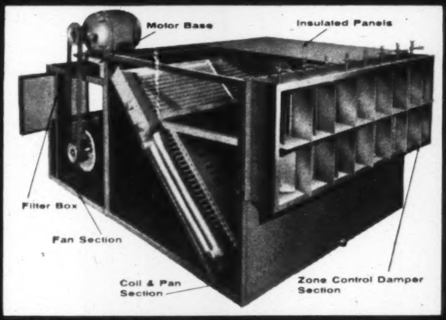
Squier machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

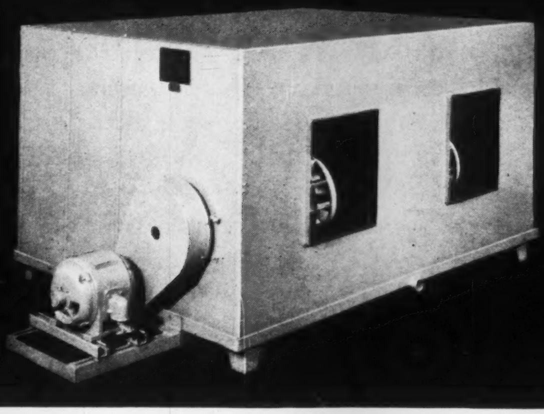
CABINETS

YOUR NEXT JOB?

Our new compact high-pressure unit (4″ to 8″ water gauge) not only permits a minimum-sized cabinet, ducts and grills; but minimizes the need for mechanical refrigeration during marginal weather. Sprayed-coil washer section provides high saturation efficiency. Here is a complete factory-fabricated package with air washing, humidifying and evaporative cooling in addition to standard central station air conditioning functions. Available with attached sound attenuator, if desired. Write for Bulletin AC-150.

Heating and Ventilating in efficient packages ready to install. These are basic fan sections of the same quality design as used in our finest air conditioning cabinets—and may be had with or without Aerofin heating coils, filter and mixing boxes, dampers and 'Buffalo' 45° or 90° stationary or adjustable outlet elbows. Units may be installed for vertical or horizontal operation. Cabinet support clips permit either floor mounting or ceiling suspension. For arrangements, capacities and dimensions, write for Bulletin UH-130.



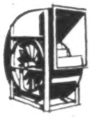


and suggestions on equipment for any air conditioning application you may require.

FORGE COMPANY

NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.



Buffalo air handling equipment to move, heat, cool, dehumidify and clean air and other gases.

Buffalo Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

ELECTRIONIC control.

The ELECTRIONIC Handbook
ELECTRIC-ELECTRONIC
AUTOMATIC CONTROLS . . . BA

Use electricity, the dependable power source

. . . and electronic thermostats with no moving parts

. . simpler than a radio

More reliable than an elevator

Everywhere you turn, reliable electric and electronic components and systems work for you. You hardly think about them — your radio, an elevator, your dictating machine, the generator cutoff in your automobile.

Barber-Colman *Electrionic* control for heating, ventilating, and air conditioning provides even more dependable service than the items listed above. It combines electric and electronic components to give you fast, accurate sensing and adjustment of temperatures and air flow. You don't have to convert electrical energy into mechanical energy in an *Electrionic* control system — it makes direct use of the electrical power that's available in every building.

Simpler than a radio, it's easy to service. More reliable than an elevator, it seldom needs attention. It is instantaneously responsive and extremely accurate. For large or small installations, *Electrionic* control often costs less in the first place, and always costs less in the long run.

You don't have to be an electric or electronic engineer to understand *Electrionic* control. You will feel right at home with it after you've read Barber-Colman's new *Electrionic* Handbook which graphically explains the principles in a very readable way. You're welcome to a copy. Just call your local Barber-Colman automatic controls office or write:

. . . to operate transistorized motor operators for accurate control of air and liquid flow.

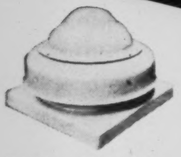
BARBER COLMAN

BARBER-COLMAN COMPANY
Dept. F, 1601 Rock Street, Rockford, Illinois

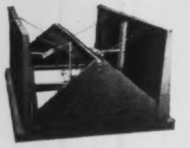
Swartwout's on the move...

with NEW Expanded Production Facilities

with NEW Advanced-Design Ventilators

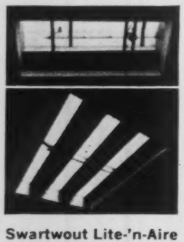


Swartwout Fiber-Aire
Being tagged "the invisible ventilator" by architects and engineers throughout the country because its molded-in sky-blue color blends with the sky . . . whisper quiet because of its indestructible fiberglass housing. Unexcelled efficiency and economy . . . direct and belt drive . . . 180 to 13,150 CFM.



Swartwout Pyrojector
The emergency relief unit with the extra features that give positive protection . . . completely automatic . . . confines sprinkler release area . . . always on guard to halt fire, smoke and explosive damage.

Insta-Curb
A prefabricated ventilator curb of heavy gauge, all welded, painted steel construction . . . separate cant pieces in all 4 corners. Low cost . . . saves time . . . eliminates errors.



Swartwout Lite-'n-Aire Heat Valve and Lite-'n-Aire Airmover
First units to combine ventilation with skylighting . . . translucent fiberglass components provide natural light without hot spots or glare with dampers open or closed. Save space . . . improve appearance . . . cut installation and initial costs.

Lite-'n-Aire Heat Valve, Lite-'n-Aire Airmover and Pyrojector can be painted with Swartwout special SX100 "sky-blue" paint.

In moving its entire ventilator production from Cleveland to this modern 72,000 square foot plant in Kokomo, Indiana, Swartwout is setting new standards for production efficiency and product quality. Just one example of the several new production methods now in use at Swartwout are automatic, powered assembly jigs that change from size to size at the touch of a button. Results of this kind of imaginative manufacturing are faster production . . . higher quality.

More on the way!

This is just the beginning . . . In the next few months you'll be seeing more and more of these industry-leading engineering achievements from Swartwout.

Swartwout

SWARTWOUT
Fabricators, Inc.

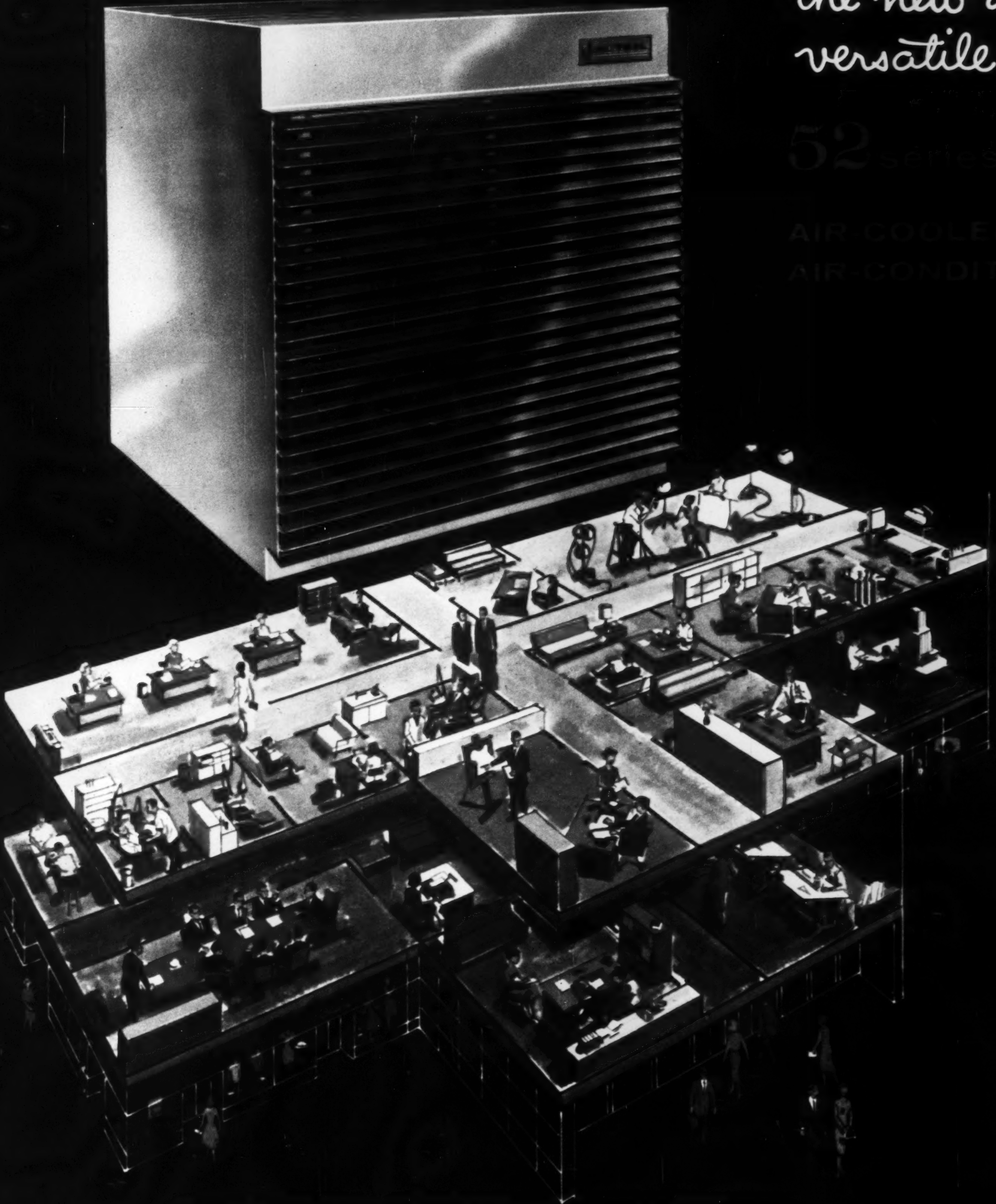
Kokomo, Indiana

In Canada: Eastern Steel Products Ltd., 8 Bermondsey Road, Toronto, Ontario
Write for full information and prices.

JANITROL *presents the new and versatile*

52 series

AIR-COOLED AIR-CONDITIONER

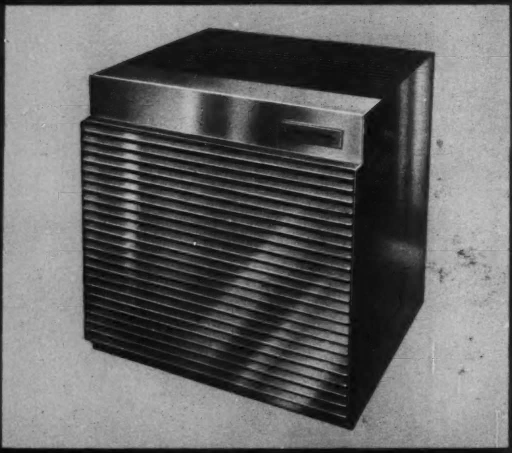


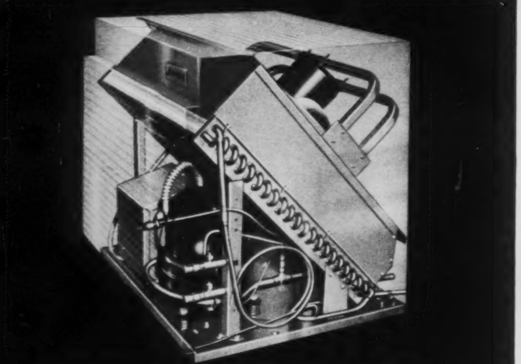
A PRACTICAL APPROACH TO ECONOMICAL,
HIGH EFFICIENCY COOLING FOR COMMERCIAL—
INDUSTRIAL BUILDINGS . . .

UNCHALLENGED COOLING PERFORMANCE...

in all-new JANITROL

52 SERIES CONDENSING UNITS





A COMPLETE LINE TO MEET ALL NEEDS . . .
CAPACITIES FROM 22,200 TO 110,200 BTU/HR.

Outwardly beautiful and pleasing to the eye, inwardly rugged and powerful, new Janitrol 52 Series provides low-cost central cooling with matchless reliability and efficiency. Here are some of the many ways new Janitrol 52 Series condensing units are demonstrating their excellence . . .

In Performance . . . condensing coils have greater area to dissipate more heat and to provide higher efficiency. Operation with outside temperatures as high as 125°F.

In Styling . . . modern, simple and functional cabinet that will be in the best of taste in any landscape plan. Finished in beautiful, durable, weather-resistant, automotive-type enamel.

In Economy . . . powerful, top-mounted fan draws in quantities of cooler ground air over the condensing coil, which is shaded from the sun's heat by louvers.

In Quietness . . . compressor and fan are unusually quiet in operation. Cabinet is acoustically treated with a weatherproof, sound-absorbent material.

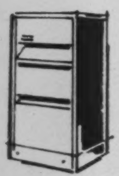
In Safety . . . upflow exhaust protects nearby plants from hot blasts . . . enclosing grilles safeguard pets and children.

In Service . . . all components are easily accessible. Service panels may be removed without affecting operation, to make checks while unit is in full operation.

A.R.I. CERTIFIED

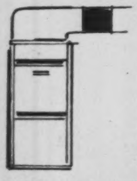
Full A.R.I. certification is your assurance this equipment meets or exceeds standards of the Air Conditioning and Refrigeration Institute. A five-year written warranty backs up your choice.

JANITROL AIR-COOLED SUMMER AND YEAR 'ROUND COMFORT SYSTEMS TO MEET ALL NEEDS



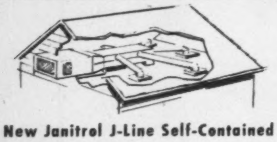
Janitrol Win-Sum-Matic Year 'Round Systems

A complete central heating and cooling unit in a compact, smartly-styled cabinet smaller than most home refrigerators! Features air-cooled summer cooling, thrifty gas heat with Dura-Tube heating heart, guaranteed for 20 years! Exclusive "Season Selector" control allows changing from heat to cool (or vice versa) in seconds. No special tools or service call needed.



Janitrol Add-On Cooling System

With Janitrol Add-On Cooling, most any forced air furnace can be easily adapted to circulate cool, filtered air to every room in the home. The Janitrol evaporator coil is installed in furnace outlet duct and connected to the properly-sized 52 Series condensing unit. The existing furnace blower and duct system circulates the cooled, dehumidified air. Here's full central air conditioning at low, low cost!



New Janitrol J-Line Self-Contained Air Conditioners

The Janitrol J-Line models are an economical answer to cooling needs. In one compact unit are the blower, compressor and evaporator coils. Operation is remarkably quiet. May be used with ducts or as free discharge. Installs through walls in crawl space, in attic or other limited access locations.

Janitrol Schoolroom Cooling and Heating

Janitrol offers a self-contained room heating and ventilating system (with optional cooling) that features perimeter-type, draftless air distribution. Installation economies are noteworthy (savings up to 60% over large central systems). For new schools, additions and modernization.

WRITE TODAY!

for complete information on Janitrol heating and cooling systems for your business needs. Remember—architects and engineers can specify . . . and dealers can recommend and install *Janitrol* equipment with complete confidence it will provide the finest, most carefree performance possible.

JANITROL
HEATING AND AIR CONDITIONING
A Division of Midland-Ross Corporation
Columbus 16, Ohio • In Canada Moffats Ltd., Toronto 15

Builder: Turner Construction Company. Architects & Engineers: Voorhees Walker Smith Smith and Haines. Mechanical Contractor: Lloyd E. Mitchell, Inc. Pipe Jobber: Lee L. Dopkin, Inc., of Baltimore. Owners: Sinai Hospital of Baltimore, Inc.

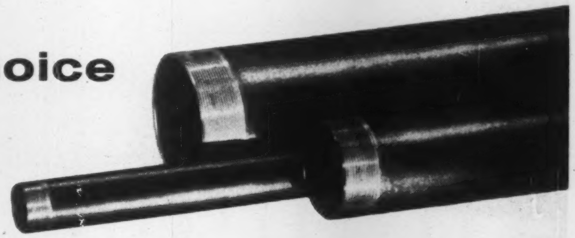
Dedicated to Longevity

BOTH THE HOSPITAL . . . AND ITS STEEL PIPE

Name:	The new Sinai Hospital	*Name:*	Bethlehem general-purpose steel pipe
Location:	Baltimore, Md.	*Location:*	Plumbing and heating lines
Dedication:	September 20, 1959	*Quantity:*	300 tons
Capacity:	483 beds	*Sizes:*	2 through 4 in. continuous buttweld pipe 5 through 16 in. electric resistance-weld pipe
Floor Area:	600,991 sq ft		
Cost:	$20,000,000	*Cost:*	Lowest of all piping materials

Steel Pipe is First Choice

FOR LASTING STRENGTH . . .
ECONOMY . . . WORKABILITY

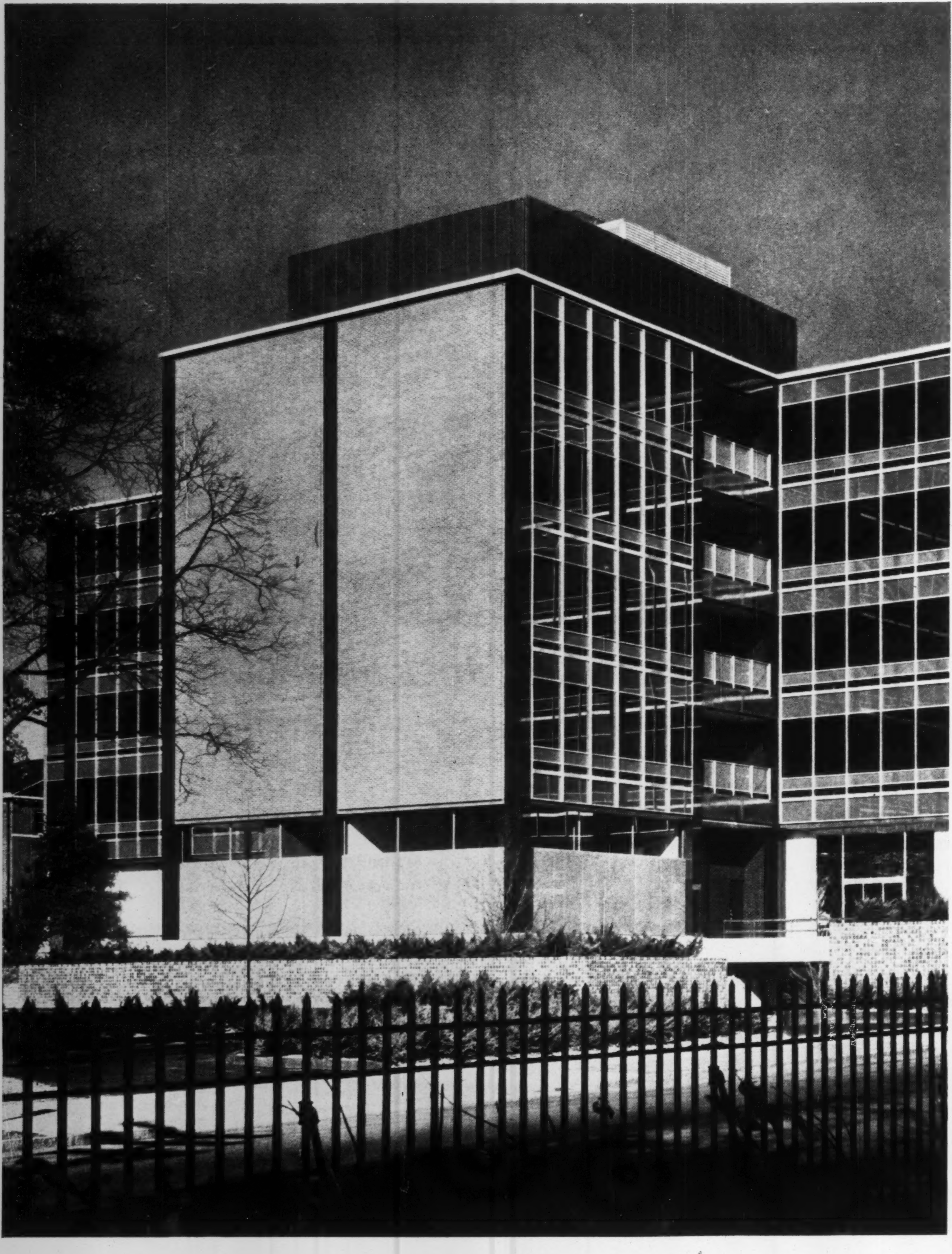


Insist On Steel Pipe Made in USA

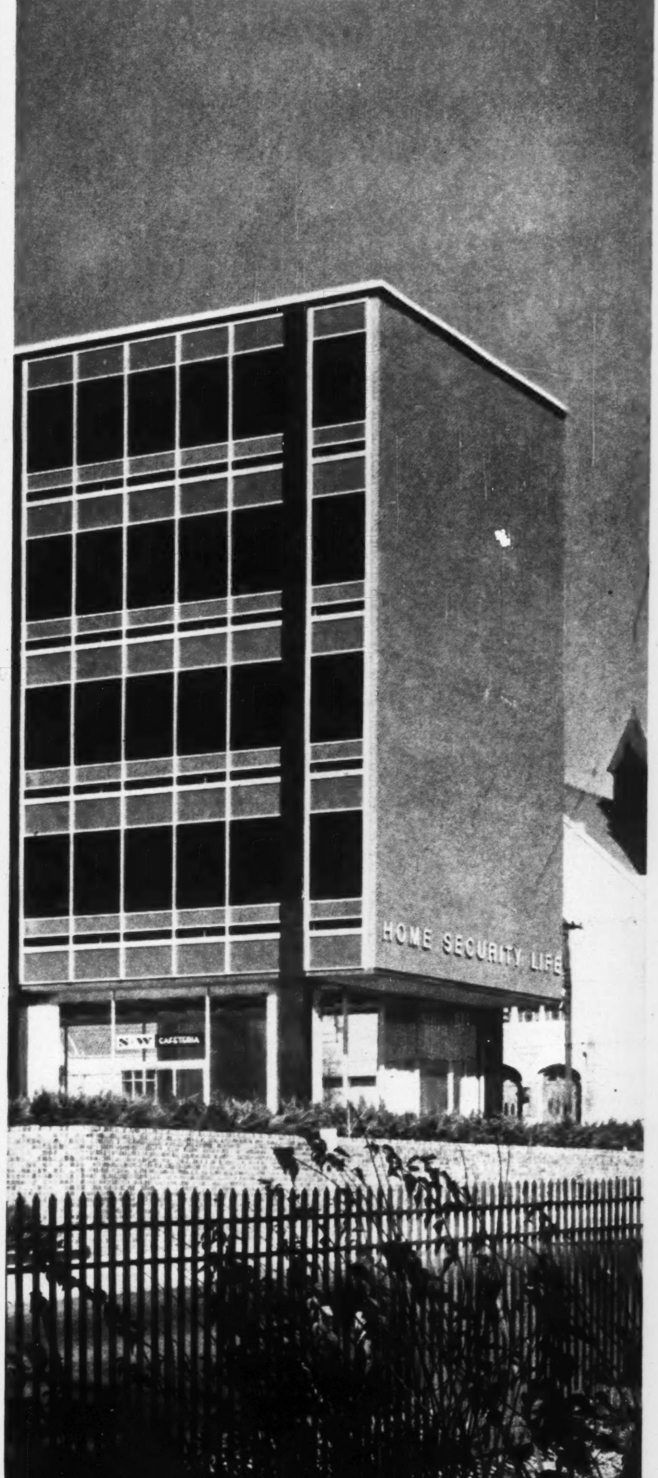
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



New headquarters of Home Security Life Insurance Co., Durham, North Carolina, completely air conditioned with Gas-operated Carrier Absorption Refrigeration. Associated architects: Small & Boaz; Antonin Raymond & L. L. Rado. Consulting engineers: General Engineering Associates. General contractor: George W. Kane. Mechanical contractor: W. H. Sullivan Co., Inc.

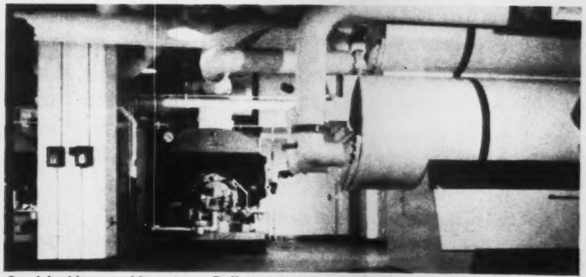


Insurance company insures comfort cooling with GAS-operated CARRIER Absorption Refrigeration

The attractive new home office of Home Security Life Insurance Company in Durham, North Carolina, is as modern in personnel comfort as in its design. It is completely air conditioned with one of the most efficient systems available – Gas-operated Carrier Absorption Refrigeration serving 190 Modular Weathermaster* room units.

The Carrier absorption system is the essence of simplicity and economy. No prime mover is required. The energy source is low-pressure steam from a gas-fired boiler. Water is the cooling agent. Boiler capacity is put to use on a year 'round basis . . . cooling in summer, heating in winter. And thrifty gas keeps fuel costs low.

For comfort cooling at low cost, specify Gas and Carrier Absorption Refrigeration. Performance data and cost details are yours for the asking. Call your local gas company, or write Carrier Corporation, Syracuse 1, N. Y. **AMERICAN GAS ASSOCIATION**



Good-looking machine room. Reflects up-to-date design of entire building. Here the gas-operated Carrier unit operates at 250-ton capacity to cool 575 GPM water from 52.5 F to 42 F, when supplied with 12 psig steam. *Reg. U. S. Pat. Off.

FOR HEATING & COOLING GAS IS GOOD BUSINESS!

New! another First

World's First Combination Gas Heating/Electric Cooling in One Compact Unit that Fits a 3′ x 3′ Closet!

Especially created to solve your heating-cooling problems for apartments, motels, dormitories, nursing homes, medical centers, small commercial jobs

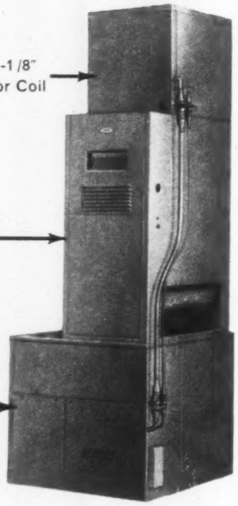
Never before so *much* in so little space—40,800 Btuh heating output (all gases)—22,000 Btuh cooling at ARI standard—all from a compact unit measuring only 89″ high and taking only 3′ x 3′ of floor space. Truly a remarkable achievement—a new climax in 65 years of Lennox engineering leadership!

Matching the compactness of this revolutionary new "package" is its unequalled adaptability. Not only is it ideally suited for installation in a 3′ x 3′ utility closet with exterior wall but, also, it is equally suitable for air-shaft or remote applications. It is so compact, it may be installed when building is in finishing stage.

For full information or the name of your Lennox Technical Representative—address: Lennox Industries Inc., 430 South 12th Avenue, Marshalltown, Iowa.

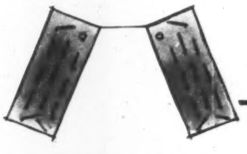
Refrigerant Quick Connectors

No welding! No screwed joints! No adapters! Only one mechanical joint! Pre-charged refrigerant lines with U.L. listed self-sealing "quick couplers" permit safe storage and greatly simplify the field installation of the factory-charged condenser and evaporator units and their connecting tubing.

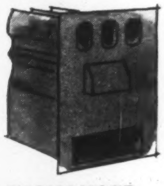


from Lennox

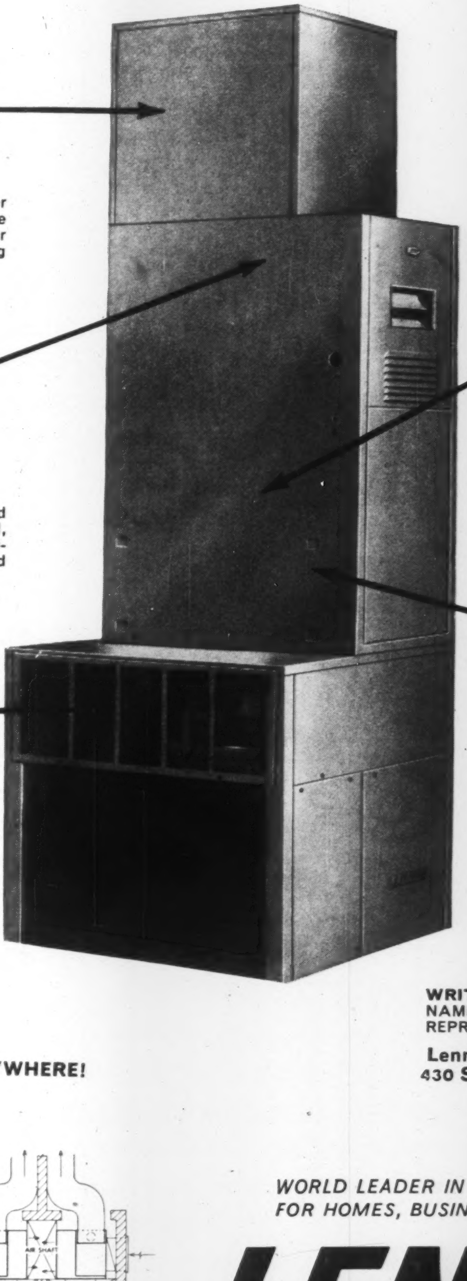
40,800 Btuh heating output—
22,000 Btuh cooling at ARI standards—from a unit only 89″ high

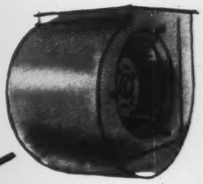


EVAPORATOR COIL
More than 1 sq. ft. net face area per ton of rated capacity. Low resistance to air travel reduces blower power requirements. High dehumidifying capacity.

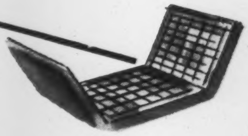


HEAT EXCHANGER
Heavy gauge steel, continuous welded construction. Three aluminized steel, ribbon-type gas burners easily removable for cleaning. Factory-installed back draft diverter.

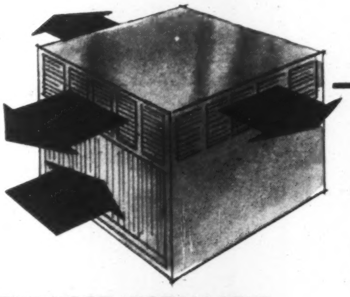




BLOWER
Direct drive; delivers ample cooling air quietly, economically. Blower and resiliently mounted motor operate at low rpm, deliver constant air volume against normal, varying static pressures.

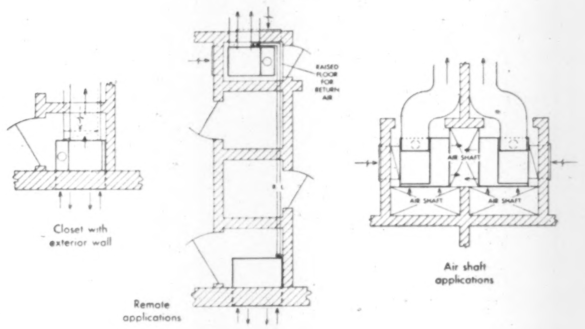


FILTER
Another Lennox "exclusive"—has TWICE the usual filtering area: 74 sq. in. per 100 cfm of delivered air. Throw-away type filter media, 1″ thick, easily accessible for changing.



THE MOST INSTALLABLE PACKAGE EVER ENGINEERED
Condenser air may be discharged from coil side of unit or from right- or left-hand side—furnace section may be rotated 180°—permitting terrifically wide range of applications.

MAY BE INSTALLED 'MOST ANYWHERE!



Closet with exterior wall

Remote applications

Air shaft applications

WRITE TODAY FOR INFORMATION OR NAME OF YOUR LENNOX TECHNICAL REPRESENTATIVE.

Lennox Industries Inc.
430 S. 12th Ave., Marshalltown, Iowa

WORLD LEADER IN INDOOR COMFORT
FOR HOMES, BUSINESS, SCHOOLS, INDUSTRY

LENNOX®

© 1960 Lennox Industries Inc., founded 1895; Marshalltown and Des Moines, Iowa; Syracuse, N.Y.; Columbus, O.; Decatur, Ga.; Ft. Worth; Los Angeles; Salt Lake City. In Canada: Toronto, Montreal, Calgary, Vancouver, Winnipeg.

NOW—

CHANGE VALVE TRIM IN 15 MINUTES

New Leslie Cage Trim Control Valve is Designed for Today's Use and Tomorrow's Changes.

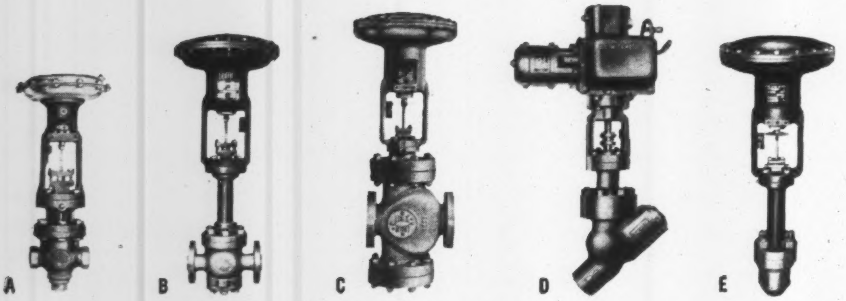
Here's a control valve designed in steel and alloy steels that offers new assurance the valve you initially specify and install *will always fit an application*—even if changes in plans or future system changes might ordinarily call for complete valve replacement.

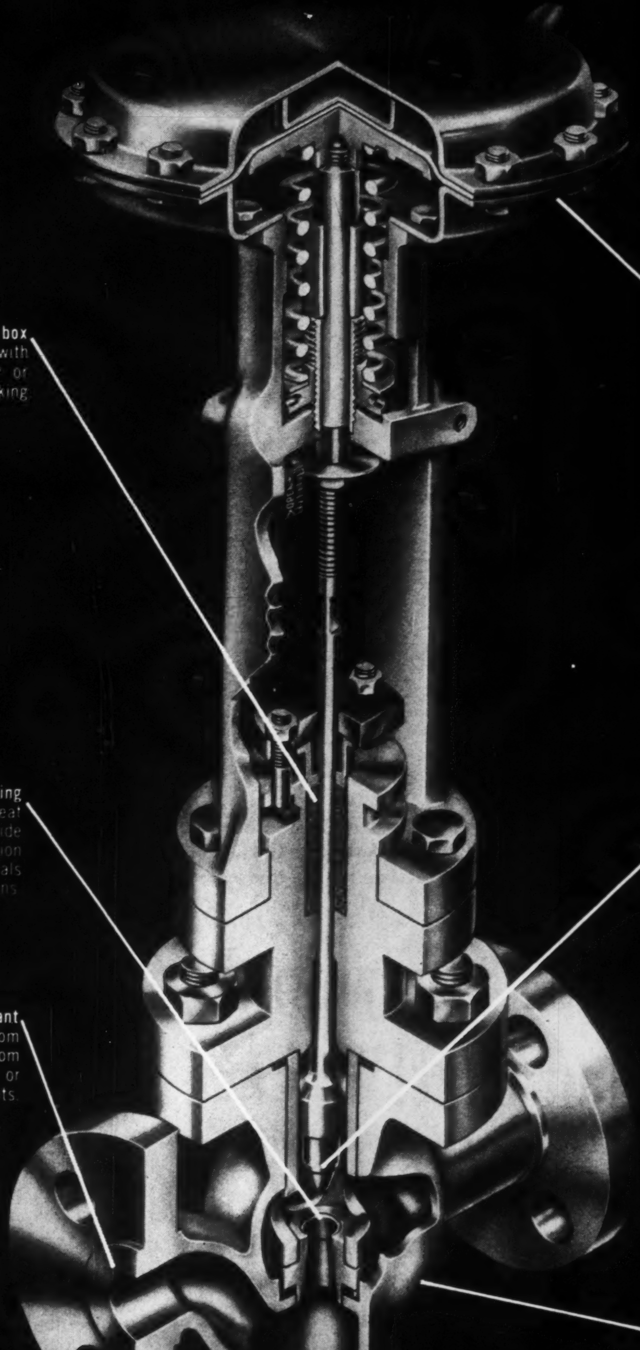
The new Leslie cage trim valve allows complete trim inspection in 15 minutes without removing the valve from the line. You can also switch valve action or size of actuator. Or, change valve characteristic or trim materials at will with an inexpensive interchangeable trim kit that reduces spare valve and valve parts inventories. Cage trim cuts maintenance and system modification costs to the bone—it's the kind of valve that makes foresight almost as good as "hindsight".

For sizing and capacity data on cage trim control valves, write for Bulletin or contact your Leslie Engineer—he's listed under 'Valves' or 'Regulators' in the Yellow Pages.

Leslie Co., 703-A Grant Ave., Lyndhurst, New Jersey

- **A** Unbalanced valves up to 2500 lb ASA ratings.
- **B** Piston balanced valves up to 600 lb ASA ratings.
- **C** Double seated control valves to 600 lb ASA ratings.
- **D** High pressure-high temperature control valves.
- **E** Angle body control valves.





Flanged, thru-bolted stuffing box—no lubricator needed with Leslie-Lubrisoft* or Teflon V-Ring packing

Long-Life, Stellite seating surface on renewable seat insert for steam service. Wide selection of alternate corrosion and erosion resistant materials for other applications.

Corrosion-erosion resistant materials in ASA rating from 150 to 2500 lbs. Select from a wide line to meet present or future system requirements.

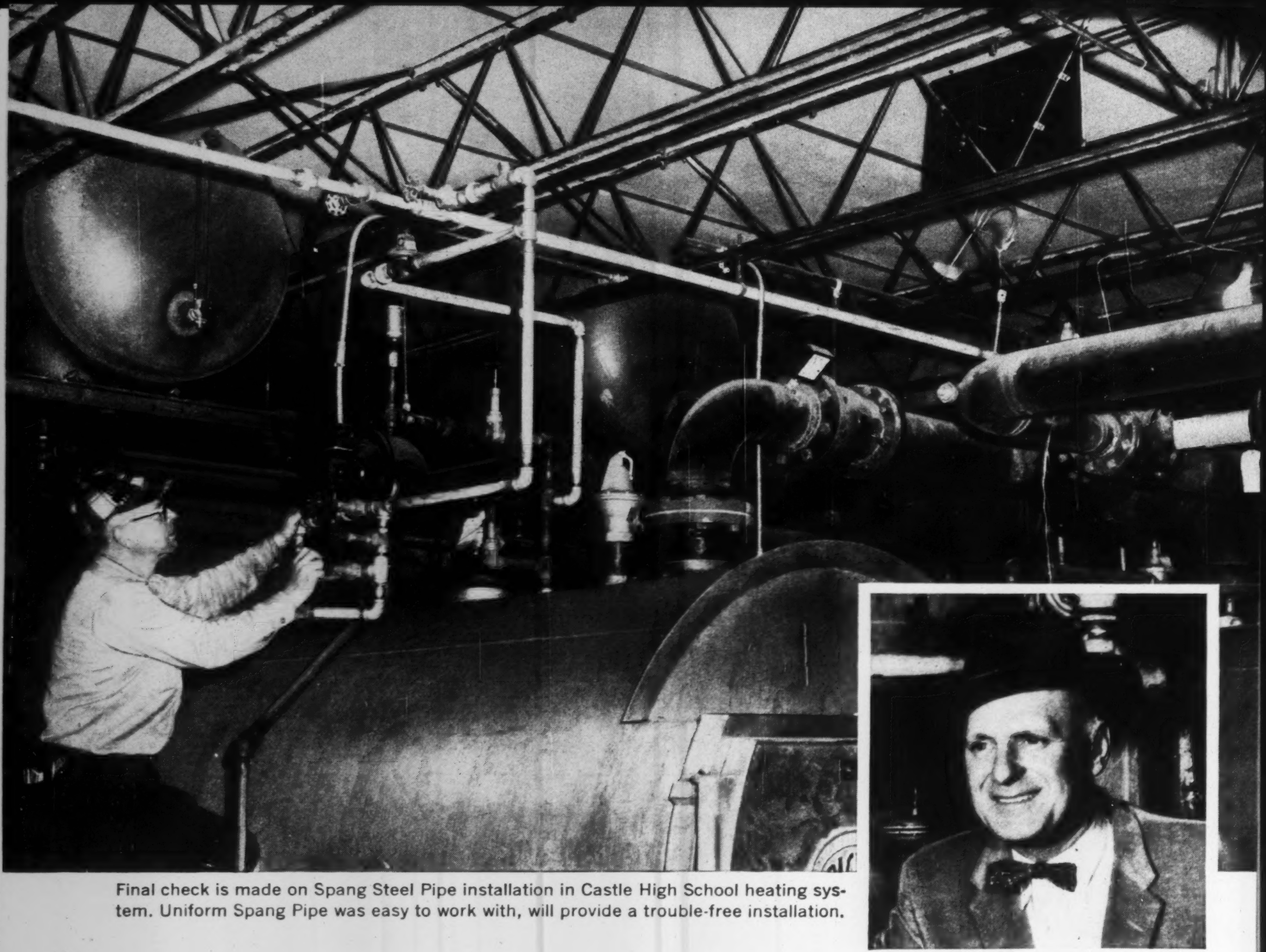
Actuators for normally open or normally closed valves with 35, 55, 85 and 135 square inch effective areas.

Interchangeable inner valve shapes and materials—choice of needle plugs, V-port, quick opening, micro tapers.

High Capacity Body any end connections in ½ to 3" sizes.

TRADE
LESLIE
MARK

REGULATORS and CONTROLLERS



Final check is made on Spang Steel Pipe installation in Castle High School heating system. Uniform Spang Pipe was easy to work with, will provide a trouble-free installation.

"SPANG® is tops . . . they don't make any better steel pipe than that!"

says Mr. Jack C. Gottman, Jack C. Gottman & Co., Evansville, Indiana

"We always use 'good' pipe in our installations, and usually it's Spang," reports Mr. Gottman. "That's why we used Spang Steel Pipe in the heating system at Castle High School, Paradise, Indiana.

"Spang Steel Pipe is uniformly straight and true. It has a good galvanized finish that doesn't chip or peel in bending, and it threads nicely. It makes a good appearance in exposed locations, too. We expect Spang will give good service at Castle High for the lifetime of the school."

Quality control makes Spang tops in performance, dependability

Close manufacturing control from skelp through inspection builds into Spang Steel Pipe all those qualities you want on any job: uniformity of diameter, wall thickness and threads; straightness, clean interior, good finish, easy workability—and most of all—durability for long service life.

See your local Spang Distributor for good service on your next order. Remember: make it steel pipe . . . make it Spang Steel Pipe . . . made in USA.

Architect: Lester W. Routt & Associates, Vincennes, Ind.
General Contractor: Peyronnin Construction Company, Evansville, Ind.
Mechanical Contractor: Jack C. Gottman & Co., Evansville, Ind.
Spang Distributor: Plumbing & Industrial Supply Co., Inc., Evansville, Ind.

SPANG CW STEEL PIPE

THE NATIONAL SUPPLY COMPANY

Two Gateway Center, Pittsburgh 22, Pennsylvania

Subsidiary of Armco Steel Corporation

ARMCO

A statement
of marketing
policy
Ucon
BRAND
refrigerants
Ucon

UCON IKE's Written Policy:
Tops in Friendly Service!

America's newest refrigerants Ucon Brand Refrigerants, come to you with a fresh, new idea in service . . . symbolized by Ucon Ike.

This is service planned for *you*, and backed by a unique, published marketing policy. It's service that reaches you regularly through friendly, competent, imaginative people—the kind of people who can make doing business easier, peak seasons or slack.

So, when you want top-quality refrigerants *plus* the best in service, look for Ucon Ike. He stands for the *real* difference in refrigerants!

Ucon Refrigerants: 5 top-quality grades; full range of unit sizes; color-coded at the top; personalized service.

Ucon Brand Refrigerants are manufactured by
UNION CARBIDE CHEMICALS COMPANY— Division of Union Carbide Corporation
30 East 42nd St., New York 17, N. Y.
Exclusive Sales Agent to Air Conditioning and Refrigeration Wholesalers
ANSUL CHEMICAL COMPANY, Marinette, Wisconsin

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Ucon BRAND refrigerants
exclusive sales agent
ANSUL

In the busy summer months ahead...

INSIST ON

genetron®

SUPER-DRY REFRIGERANTS

...and be sure of the best!

genetron 11 ORANGE LABEL CCl_3F
TRICHLOROMONOFLUOROMETHANE

genetron 12 WHITE LABEL CCl_2F_2
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genetron 22 GREEN LABEL $CHClF_2$
MONOCHLORODIFLUOROMETHANE

genetron 113 PURPLE LABEL $C_2Cl_3F_3$
TRICHLOROTRIFLUOROETHANE

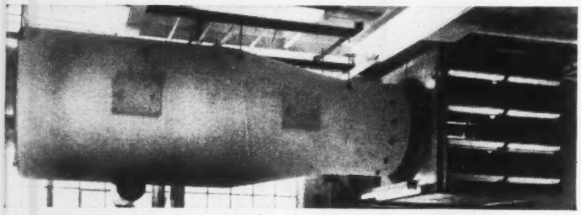
genetron 114 BLUE LABEL $C_2Cl_2F_4$
DICHLOROTETRAFLUOROETHANE

genetron super-dry refrigerants are universally accepted for use as original or replacement charge because their tight production standards consistently **e**xceed industry specifications for purity and dryness. Refrigeration service engineers, original equipment manufacturers and wholesalers throughout the **n**ation know they can always rely on "genetron" for dependable, trouble-free performance. "Genetron" super-dry refrigerants are available from wholesalers **e**verywhere. Their high quality is backed up by fast, dependable service—including prompt return of deposits on empty cylinders—and extensive **t**echnical help. More than a million copies of the "genetron service tip of the month" are mailed out every year. Pressure-enthalpy charts are available for **r**efrigeration service engineers to use in their work. Special sound slide films on solving refrigeration and air-conditioning problems are shown regularly to **o**riginal equipment manufacturers, servicemen, contractors, trade schools and universities. Whenever you order modern refrigerants, remember the **n**ame—"genetron"! Do as so many others are doing. Use the very best! When you see your wholesaler, always insist on "genetron" super-dry refrigerants!

Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N.Y.

17 reasons why the Carrier Rotaspray Weathermaker System is



Carrier Rotaspray units may be installed rooftop mounted, ceiling suspended or outside wall mounted.

TODAY'S BIGGEST INDUSTRIAL AIR CONDITIONING NEWS!

1. Proved in use. Now in its fifth year of use in many different applications, the revolutionary Rotaspray® Weathermaker System* has proved itself vastly superior to conventional close-control systems.

2. Unitary design. Instead of one large conventional central station system serving several departments, each department has its own Rotaspray unit and can change its temperature and humidity to meet its individual needs.

3. Smaller apparatus size. A Rotaspray unit requires less than ⅓ the space of a conventional system of equal capacity, due to its high velocity design.

4. Reduces cleaning and maintenance costs. Rotaspray units, with exclusive self-cleaning design, require very little maintenance.

5. Needs no apparatus rooms. No rooms are required to house Rotaspray units, even when located outside a plant.

6. Lasts indefinitely. Rotaspray units, constructed of stainless steel, deliver a long life of trouble-free service—eliminate the need of cleaning and painting.

7. Eliminates many system components. Because of revolutionary system design, Rotaspray units need no water strainer, no water pump, no water tanks, no city water and drain piping, no apparatus room and no floor drains.

8. Needs no air filters. Instead of trying to keep dust and coarse particles out as conventional systems do, the Carrier system draws them in, separates them from the air and returns them to central point for automatic collection and disposal.

9. Better humidity and temperature control. By a new control method, the Rotaspray System eliminates dewpoint control and its problems. Within system capacity, departments simply "dial" the temperature and humidity required.

10. Low operating weight. Since Rotaspray units are smaller, require no enclosure, and have no standing water level, their weight is relatively low and units may be ceiling suspended or rooftop mounted without additional building reinforcement.

11. Constant air supply. Conventional systems use automatic dampers which close down and reduce the amount of air delivered to the room. Though this causes variations in temperature and humidity, it is a "must" in such systems to prevent excessive operating costs. With the Rotaspray System, air is always constant, yet operating economy is superior.

12. Longer fan life. In conventional systems, the fan is on the unit's leaving side where high humidities cause excessive corrosion. The Rotaspray unit, with the fan on the entering side where humidities are lower, greatly lengthens fan life.

13. Relocates easily to meet plant changes. Rotaspray units require no housing, are small enough and light enough to allow easy relocation.

14. Allows lower air quantities. Rotaspray Systems require from 5 to 10% less supply air than conventional systems. Result: better air distribution and smaller ductwork.

15. Eliminates "compromise" temperatures and humidities. With the new Rotaspray System, exact conditions can be maintained in each department. One area is not dependent upon another.

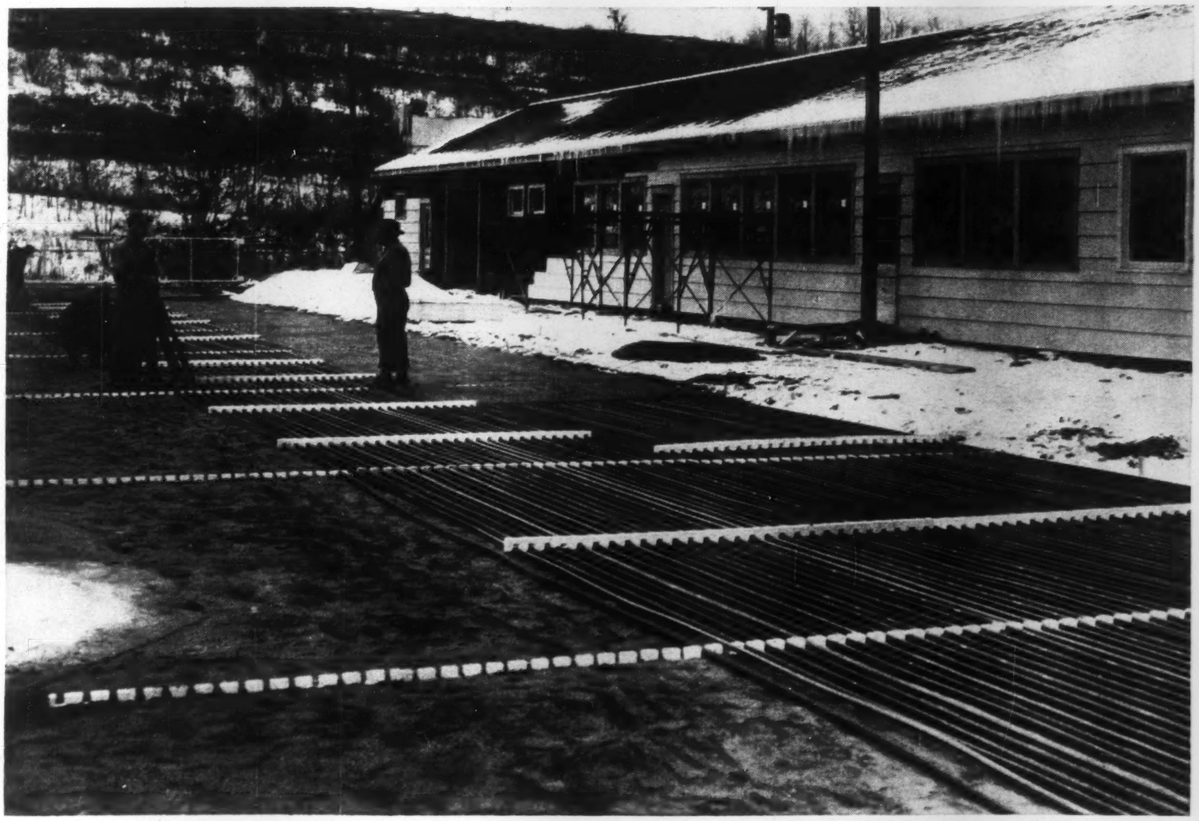
16. Install evaporative cooling now—simply add refrigeration later. When a conventional system is converted from evaporative cooling to dehumidifying service, many extensive modifications are required—such as the addition of chilled water lines, water storage tanks, etc. With a Rotaspray System, none of these must be added. Except for minor changes in the control system, the only need is the addition of a water-chilling machine.

17. Provides more at a competitive price. Though individual plant conditions vary, on the average you pay no more for a Rotaspray System than for conventional "high-quality" systems. And you get a lot more back in efficiency, economy of operation and maintenance savings. For information about the revolutionary Carrier Rotaspray Weathermaker System, write Machinery and Systems Division, Carrier Corporation, Syracuse 1, N. Y.

**Pat. Pending*

MORE PROOF OF

BETTER AIR CONDITIONING FOR EVERYBODY **Carrier** *EVERYWHERE*



New, low-cost USS National Polyethylene Ice Rink Tubing

It's now possible for any community to have a fun-filled ice skating rink for a reasonable price. More than 10 miles of USS National Polyethylene Ice Rink Tubing was used in this rink at Washington, Pennsylvania—it worked perfectly all through the winter season.

USS National Polyethylene Ice Rink Tubing is strong. It's only half as thick as other ice rink tubing; this lets the pipe cool faster and wipes out the need for extremely low brine temperatures. The new tubing installs easily. It takes just a screwdriver and a simple steel clamp to connect it to the header pipes and return bends.

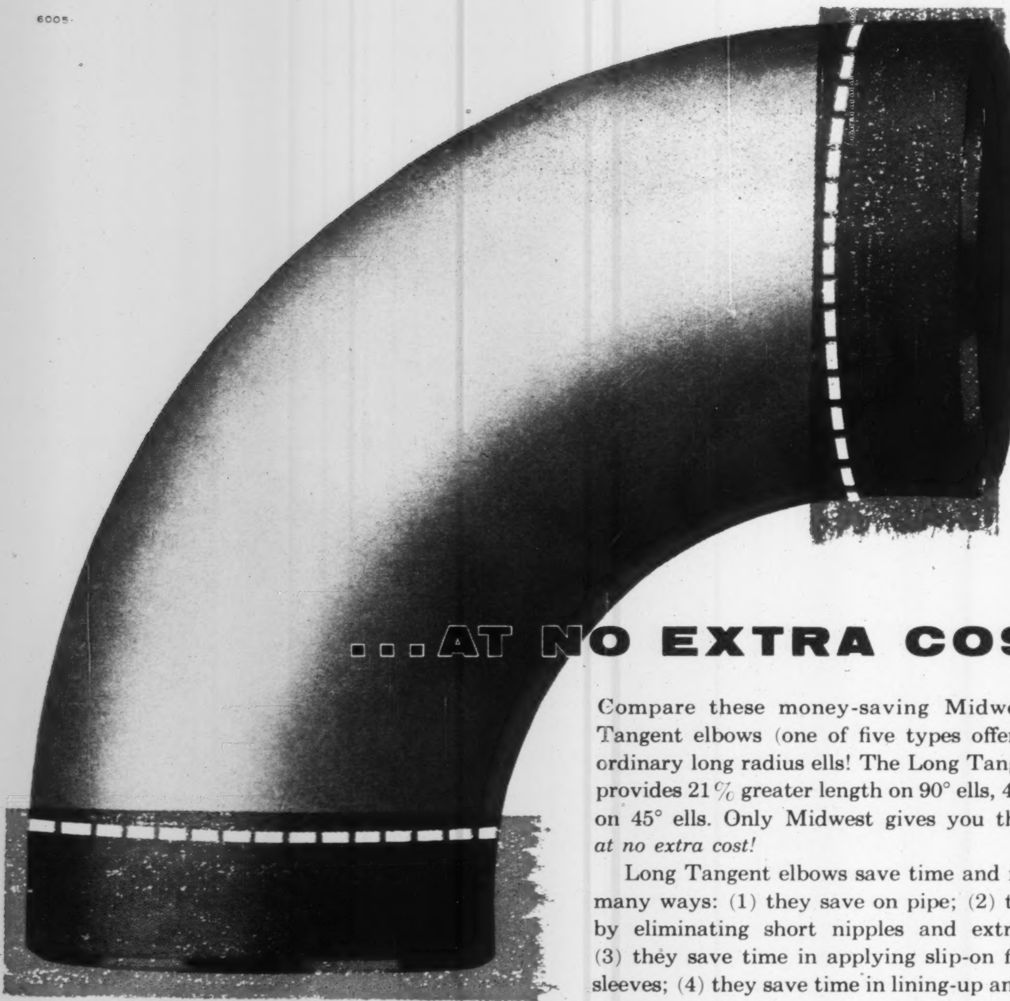
National Tube's new plastic pipe can be cut with a hacksaw. It's almost maintenance free and there's no problem with contraction. USS National Polyethylene Ice Rink Tubing is available in nominal 1-inch size, 185-foot coils weighing about 13 pounds. For information, write National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS and National are registered trademarks

USS National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York

6005



. . . AT NO EXTRA COST!

Compare these money-saving Midwest Long Tangent elbows (one of five types offered) with ordinary long radius ells! The Long Tangent type provides 21% greater length on 90° ells, 42% more on 45° ells. Only Midwest gives you this bonus *at no extra cost!*

Long Tangent elbows save time and money in many ways: (1) they save on pipe; (2) they save by eliminating short nipples and extra welds; (3) they save time in applying slip-on flanges or sleeves; (4) they save time in lining-up and clamping pipe; and (5) it is easier to replace an ordinary ell with a Midwest Long Tangent than with another ASA ell.

Only Midwest manufactures and stocks Long Tangent ells in a complete size range through 36″. Also available with special tangent lengths at slight additional charge.

Write for catalog which shows complete selection of Midwest welded-type and seamless fittings.

Sold through Stocking
Distributors from Coast to Coast

21% MORE ELBOW

MIDWEST

MIDWEST PIPING COMPANY, INC.
1450 S. Second Street St. Louis 4, Missouri

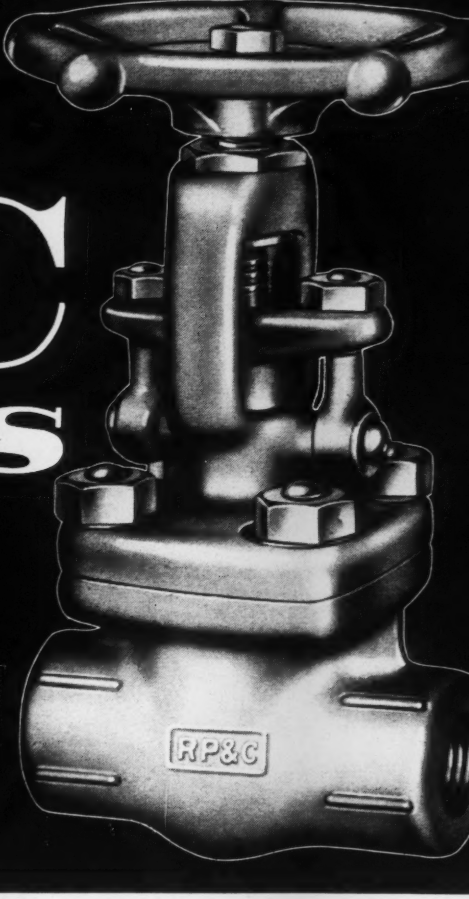
THE WORLD'S MOST COMPLETE LINE—
SEAMLESS AND WELDED-TYPE FITTINGS

ACCO for Better Values

THE COMPLETE LINE—

R-P&C VALVES

DESIGNED FOR DEPENDABILITY



This new FORGED STEEL GLOBE VALVE offers maximum strength and safety...longer life!

• R-P&C's new F80 Forged Steel Globe Valve is a versatile, precision-built addition to a distinguished valve family. Designed and engineered in cooperation with many of the country's leading engineers of the power, process piping and shipbuilding industries, the F80 Globe Valve is manufactured to the most rigid standards to overcome the problems of ever-increasing temperatures, pressures and corrosion.

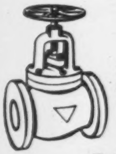
Here are a few of its many features that insure greater strength and safety, longer service life and lower maintenance cost: Forged Steel body, bonnet and gland..."375 Brinell" stem with rolled stem threads..."500 Brinell" disc-lapped seat face...molded, reinforced asbestos packing. Test Pressures: Hydrostatic Shell test, 2500 P.S.I....Seat Test (air under water), 100 P.S.I....Pneumatic Testing at 300 P.S.I. when specified. For details, *write for Folder DH-213.*

R-P&C offers a Complete Line

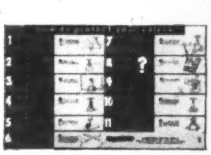
• Look to your R-P&C Distributor for R-P&C gate, globe, angle and check valves—in bronze, electric iron, cast or forged steel—in a wide range of styles, sizes and pressure classes. In addition, R-P&C offers a full line of cast steel fittings, also specialties such as asbestos-packed cocks, bar stock valves, Lubrotite gate valves and other items. For complete R-P&C catalog, write our Reading office.

BAR STOCK VALVE

BRONZE GATE VALVE



IRON GLOBE VALVE



FREE WALL CHART

"How to Protect Your Valves"

Installation pointers, operating tips, clues to longer valve life. They are all on this 22" x 17" wall chart. Write for your free copy.

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver,
Detroit, Houston, New York, Philadelphia, Pittsburgh,
San Francisco, Bridgeport, Conn.

ACCO

TEAMWORK PAYS OFF!

...when you order
your pipe through the

WHEATLAND PRODUCER-JOBBER TEAM

WHEATLAND-60

INSIST
ON PIPE
MADE
IN U.S.A.

You can be sure this winning combination will supply you with steel pipe of unvarying high quality, job after job. And your Wheatland distributor sees to it that you get the pipe you need . . . on time!

See your Wheatland Pipe Distributor for black or galvanized Wheatland Steel Pipe.

...pipe with the yearmark!

WHEATLAND STEEL PIPE

WHEATLAND TUBE COMPANY
Bankers Securities Bldg., Phila. 7, Pa.
MILLS: Wheatland, Pa. • Delair, N. J.

These pumps are designed especially for handling high temperature liquids. The following description will help you evaluate the suitability of these pumps for this specialized service.

In addition to these special features, "Buffalo" High Temperature Pumps bring you the famous "Buffalo" hydraulically efficient impeller and casing design. Accessibility, dependability and long, maintenance-free life are important *extra* values in every "Buffalo" Pump.

Whatever your heat transfer problem — including vapor phase — phone your "Buffalo" engineering representative for full information.

Only "Buffalo" Pumps bring you the famous "Q" Factor — the built-in QUALITY that provides trouble-free satisfaction and long life.

SPECIAL FEATURES OF BUFFALO HEAT TRANSFER PUMPS

•

Cast Steel Casings and Side Plates with Full Centerline Support.

•

Water Cooled Bearings and Stuffing Boxes.

•

Special Packing. Mechanical Seals are Available.

•

Smothering Gland.

•

Flexible All-Steel Coupling

•

Colmonoy-Coated Shaft Sleeve Thru Stuffing Box.

FOR MOVING HEAT TRANSFER LIQUIDS...

RELY ON "BUFFALO" HIGH TEMPERATURE PUMPS

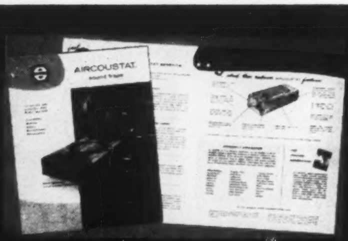
BUFFALO PUMPS

Division of Buffalo Forge Co.
171 Mortimer St., Buffalo, N. Y.
Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all
Principal Cities

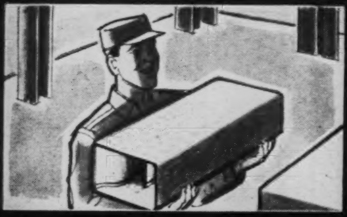
A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

7 ways AIRCOUSTAT® can save you time and money

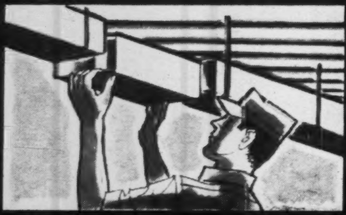
Sound Traps . . . with Guaranteed Results



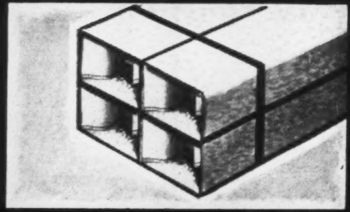
1) Easy to select—Just 3 steps to specify proper model. Save time, avoid errors.



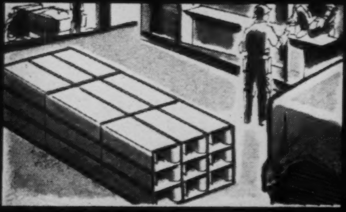
2) Easy to handle—No riggers or special equipment needed. Large units composed at job site.



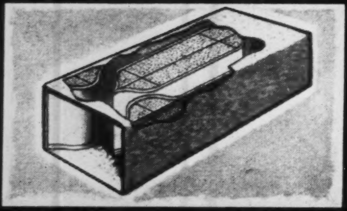
3) Easy to install—Units are installed the same as ductwork. Units have 2" extensions.



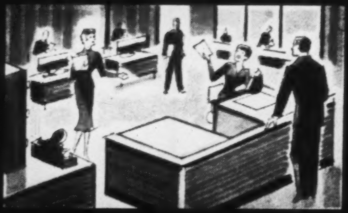
4) Fits all duct sizes—Big units are easily assembled from small Aircoustat units.



5) No storage problem—Units are delivered right to the job site, ready to install.



6) No maintenance—Units are fire-resistant, dust-proof and built to last a lifetime.



7) Guaranteed results—Solves every noise reduction problem. Units are completely reliable.

Pre-engineered by Koppers to eliminate guesswork, unnecessary calculations and difficult installations, AIRCOUSTAT Sound Traps guarantee trouble-free silencing of all duct-transmitted noise . . . at a savings in time and money to you.

AIRCOUSTAT selection is quick, simple and reliable. A choice of over 60 stock models, fabricated in 6 lengths, solves every noise reduction problem. AIRCOUSTAT is built to give a lifetime of maintenance-free service.

Write today for your copy of the AIRCOUSTAT Selection Manual, a quick guide to the right unit or combination of AIRCOUSTAT units to eliminate duct-transmitted noise in all air handling systems. Write KOPPERS COMPANY, INC., Sound Control Department, 3306 Scott Street, Baltimore 3, Maryland.

KOPPERS

SOUND CONTROL

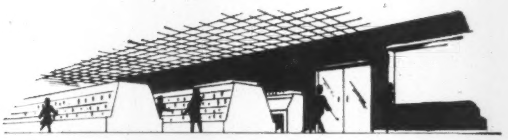
METAL PRODUCTS DIVISION

Engineered* Products Sold with *Service

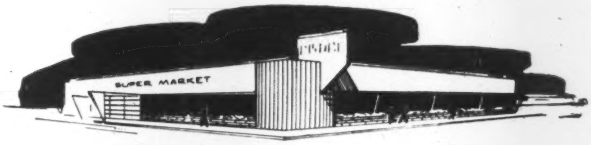
The McQuay "AL" AIRCON air cooled condenser provides the ultimate in flexibility by combining refrigerant condensing with heating and ventilating. You can utilize condenser heat for heating, and this AIRCON may also be used for exhaust ventilation, saving both time and money in installation, maintenance and operating costs.

"AL" AIRCON is compactly designed, and because of a very low silhouette, will not detract from the appearance of a building when roof mounted . . . the largest model is less than 4½ feet high, unnoticeable from the street.

"AL" AIRCON condensers are available in 8 different fan discharge arrangements and in 16 different unit arrangements . . . all standard. Each condenser coil is factory circuited in single or multiple sections to meet specific requirements of either air conditioning or refrigeration applications. Contact your nearest McQuay representative, or write McQuay, Inc., 1601 Broadway Street N. E., Minneapolis 13, Minnesota.

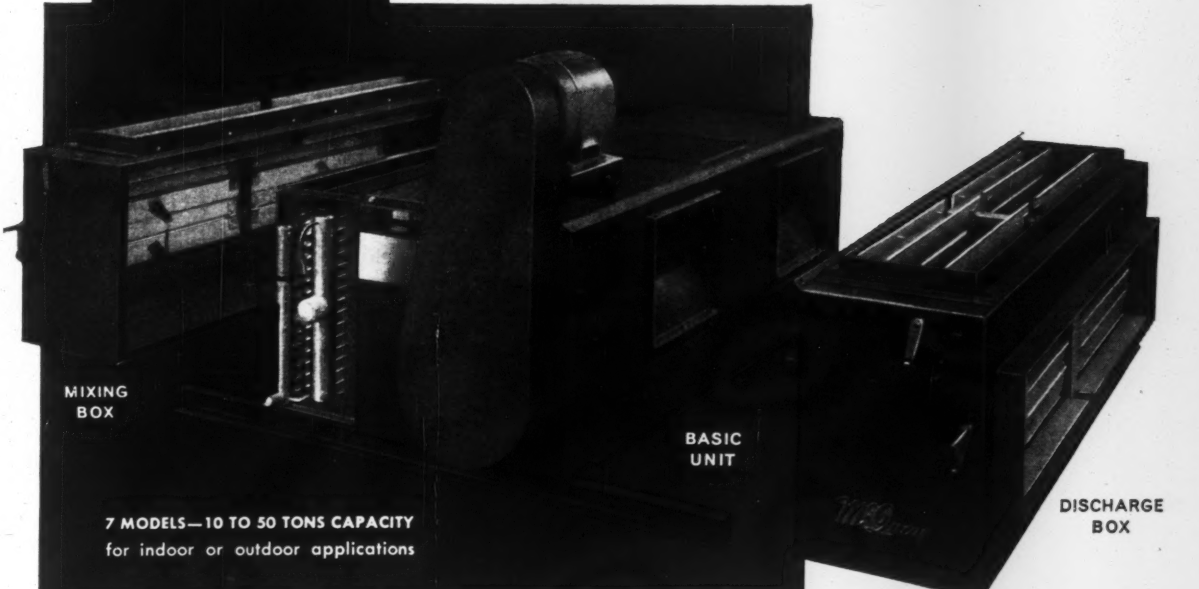


INSTALL IT INDOORS



INSTALL IT OUTDOORS

utilize condenser heat with this low silhouette blower type AIR COOLED AIRCON



7 MODELS—10 TO 50 TONS CAPACITY
for indoor or outdoor applications

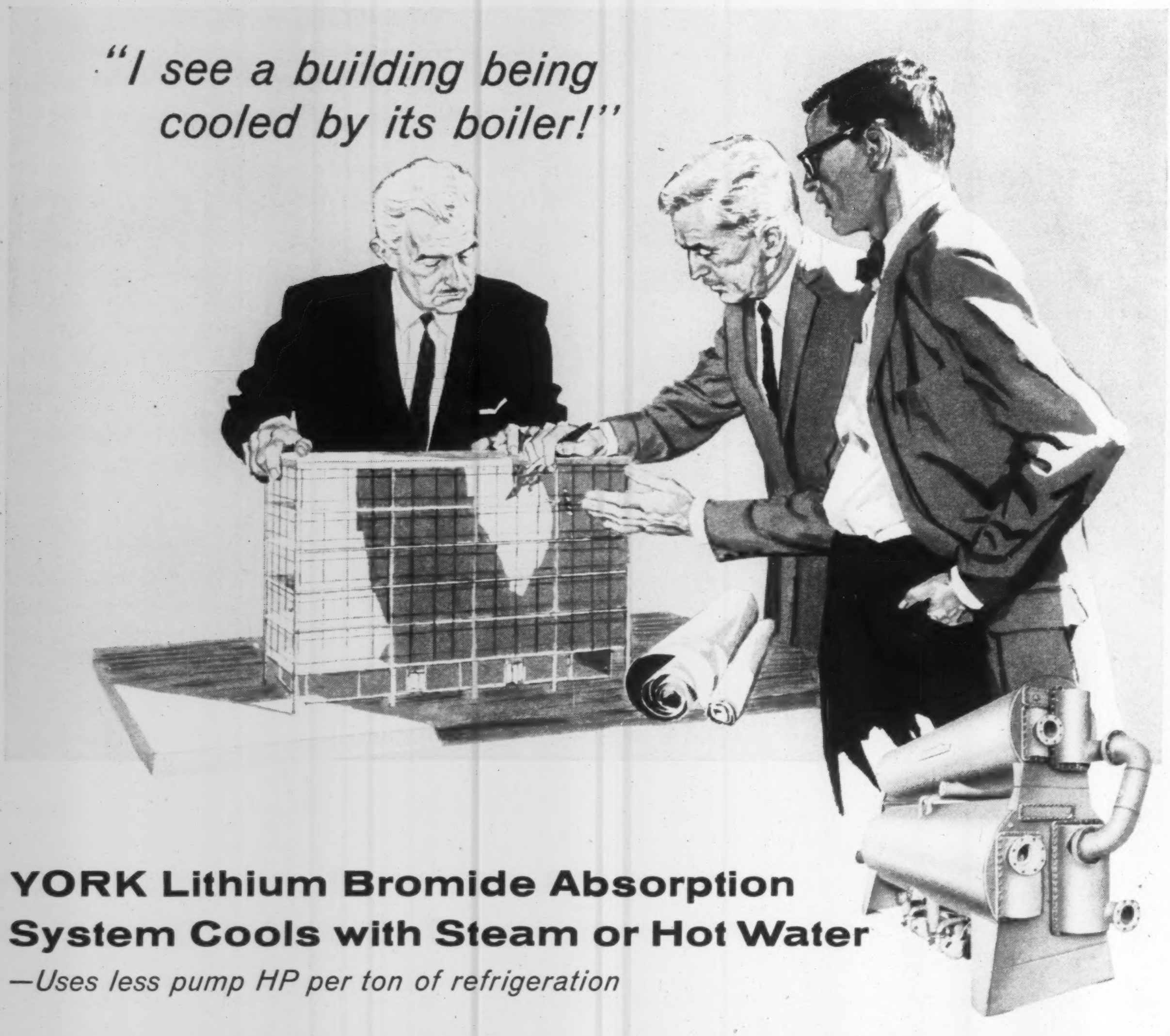
McQuay Means Quality

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

MAKE THE SEASONS COME TO YOU

"I see a building being cooled by its boiler!"



YORK Lithium Bromide Absorption System Cools with Steam or Hot Water

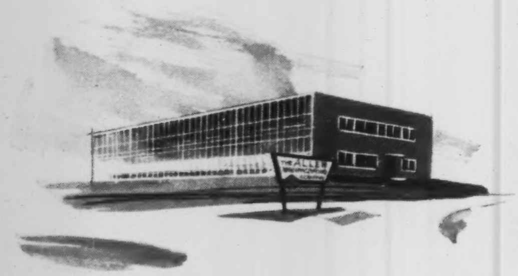
—Uses less pump HP per ton of refrigeration

CAN UTILIZE EXCESS BOILER CAPACITY—Unique system uses existing steam or hot water for economical cooling. Can cut operating costs up to 25% over ordinary motor-driven compressor systems. Refrigerant is plain water, absorbent is lithium bromide.

MORE EFFICIENT FLUID DISTRIBUTION—Advanced method of liquid flow cuts pump horsepower and reduces power costs. It also assures quieter operation, rapid start-up, close control. Fluids are non-toxic, non-explosive, never need replacement.

LOWER INSTALLATION COST—No expensive starters or heavy electrical conduit. Noiseless, vibration-free operation permits installation anywhere from basement to roof without costly foundations. Roof-top location saves piping and pipe shafts.

VIRTUALLY MAINTENANCE-FREE—Except for 3 small pumps and motors, the unit has no moving parts. Operates automatically, easily handles load changes. Steam valve provides simple, direct capacity control. 100 to 740 tons refrigeration.



Another YORK Trail Blazer Concept Proved in Action at *Allen Mfg. Co., Bloomfield, Conn.*—Excess boiler capacity in summer is used to deliver very economical cooling. A 230-ton York Absorption System air conditions the office and cafeteria, and a 170-ton unit chills process water.

YORK

YORK CORP., SUBSIDIARY OF BORG-WARNER
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YORK BW DIVISION

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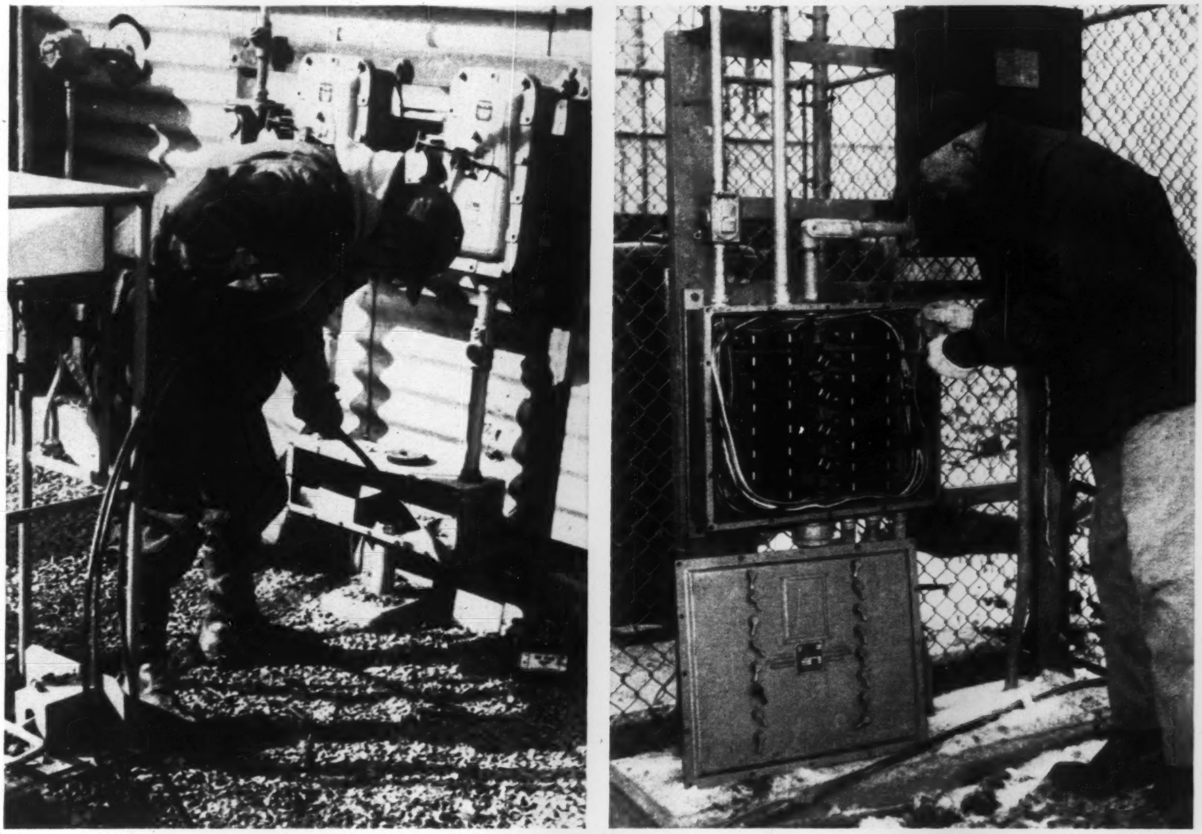
MAKE IT BETTER

Air Conditioning, Heating, Refrigeration and Ice-Making Equipment • Products for Home, Commercial and Industrial Applications

Another new development using

B.F.Goodrich Chemical ***raw materials***



New THW wire insulated with Geon is used in sizes up to 3/0 AWG at this new Sohio plant. Wire is made by the Paranite Wire and Cable Division of the Essex Wire Corporation, Marion, Indiana. B.F.Goodrich Chemical Company supplies the Geon vinyl.

"We welcome the higher factor of safety"

. . . of new THW wire insulated with GEON vinyl

These pictures show new wiring going into the Sohio Chemical plant at Lima, Ohio. Here's what the contractor, W. W. Clark Corporation of Cleveland has to say about it:

"In a chemical plant or refinery, electrical wiring often has to go near processing equipment that operates at high temperatures. We try to keep it at least a foot away, but sometimes have to go as close as 6". We welcome the higher factor of safety this new THW wire gives us."

Now you can add new heat resistance to the proved properties of insulation of Geon vinyl. Geon is tough, weatherproof and keeps its exceptional properties with age. It also resists oils, greases and chemicals.

For information about Geon wire and cable covering, or other ways that Geon improves products or opens new markets, write Dept. GG-3, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

A TRADE MARK OF B.F.GOODRICH CHEMICAL COMPANY

Geon

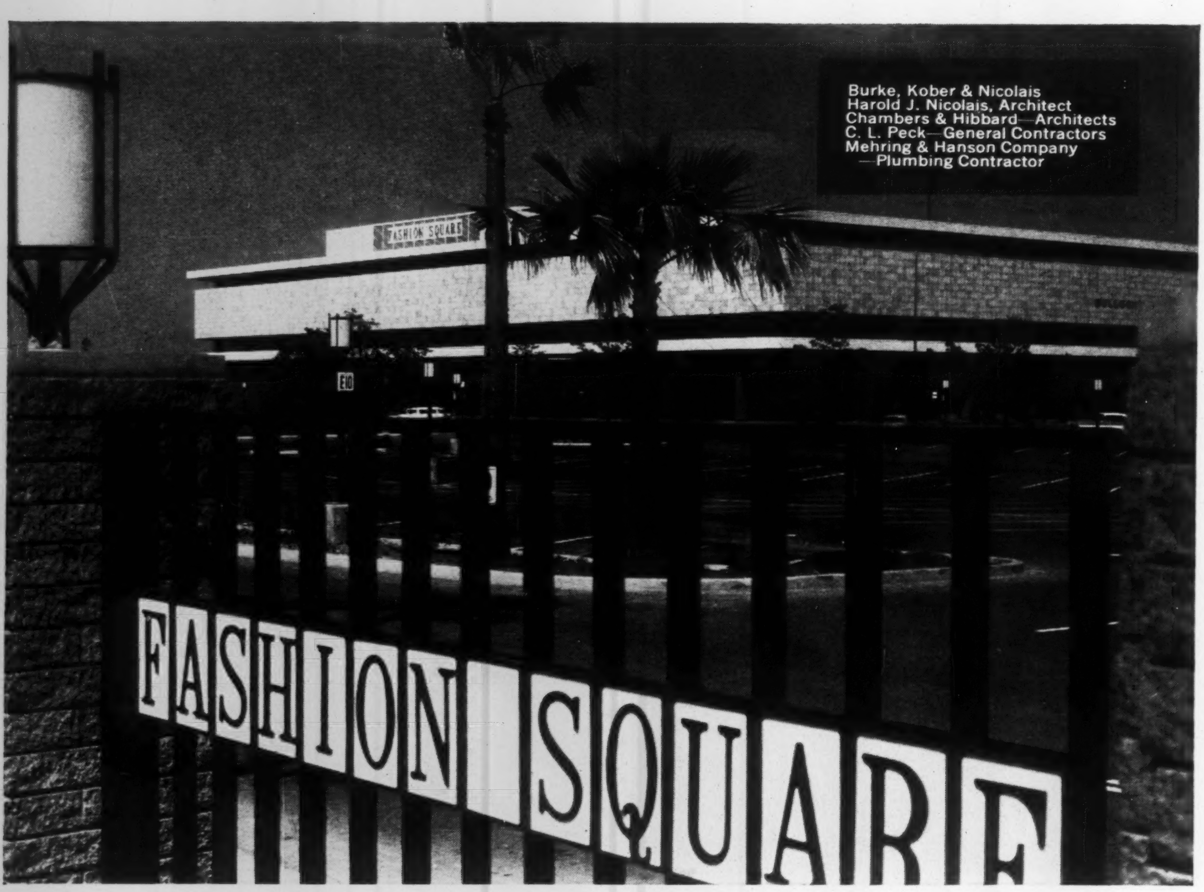
VINYLS

A DIVISION OF THE B.F.GOODRICH COMPANY

B. F. Goodrich Chemical Company

a division of The B.F.Goodrich Company

B.F.Goodrich GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers



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Found—in the finest squares and circles—**steel pipe,** the versatile tubular conductor

A new dimension in consumer services is exemplified by Fashion Square—a "first of its kind" personal service center in Santa Ana, California, conceived and built by nationally famous Bullock's, Inc.

In keeping with the Square's functionalism, *steel pipe* was logically first choice for plumbing, heating, vent lines and fire protection. Because *steel pipe* was readily available—black for fire sprinklers, galvanized for water, vent and drainage lines—its use resulted in low-cost, durable service piping that was quickly installed.

Steel pipe is always first choice when economy *plus* strength *plus* ease of working *plus* choice of finishes *plus* ready availability are required. Whatever the application—water, oil or gas transmission; fire protection, heating, cooling and plumbing; vent and drainage lines; refrigeration, ice making, radiant heating or snow melting; electrical or communications conduit—*steel pipe* serves best.

**COMMITTEE ON
STEEL PIPE RESEARCH**
150 East Forty-Second Street, New York 17, N.Y.

STEEL PIPE IS FIRST CHOICE

- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

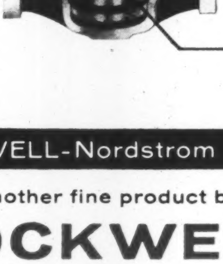
INSIST ON PIPE MADE IN U.S.A.

Yours for the asking . . .

Write for your copy of the 48-page booklet "Radiant Panel Heating with Steel Pipe." It details the design, installation and operation of radiant heating systems.

GET PRECISE SYSTEM BALANCING

with Lubricated Plug Valves



SIZES TO 36": Lines above 8" are no longer a problem. Specify sizes and pressure rating to meet your design needs.

COMPACT: No bonnet cavity or rising stem saves weight and space.

PERFECT BALANCE: Plug is smoothly, easily positioned for precise throttling . . . wrench shows degree of throttle.

THROTTLE or SHUT-OFF: If desired, shut-off valve can be eliminated downstream from throttle valve. Positive shut-off assured by pressurized lubricant.

NO CHANCE OF NOISE: Solid tapered plug is perfectly seated in rugged body . . . no exposed seats . . . silent for the life of the building.

Since Rockwell-Nordstrom lubricated plug valves are easily positioned to give the exact degree of throttle, many air conditioning design engineers have specified them for new chilled water systems. Pressurized lubricant in the exclusive Sealdport® system gives a tight seal and positive shut-off and lubricant prevents wearing metal-to-metal friction, too. More *plus* benefits of Rockwell-Nordstrom valves: *compact design* (no yoke or bonnet) to fit in tightest areas . . . *quiet operation*, because flow through the valve is smooth and easy . . . and *long life*, because it's a *lubricated* mechanism.

Get all details on Rockwell-Nordstrom, the world's most complete line of lubricated plug valves, lubricants and accessories. Mail the coupon below to Rockwell Manufacturing Company, Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited. Rockwell International, S. A., Geneva, Switzerland.

Lubrication Makes the Difference

ROCKWELL-Nordstrom VALVES

another fine product by

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Dept. 110F, Pittsburgh 8, Pa.

Please send Bulletin V-203.
Please have your representative call.

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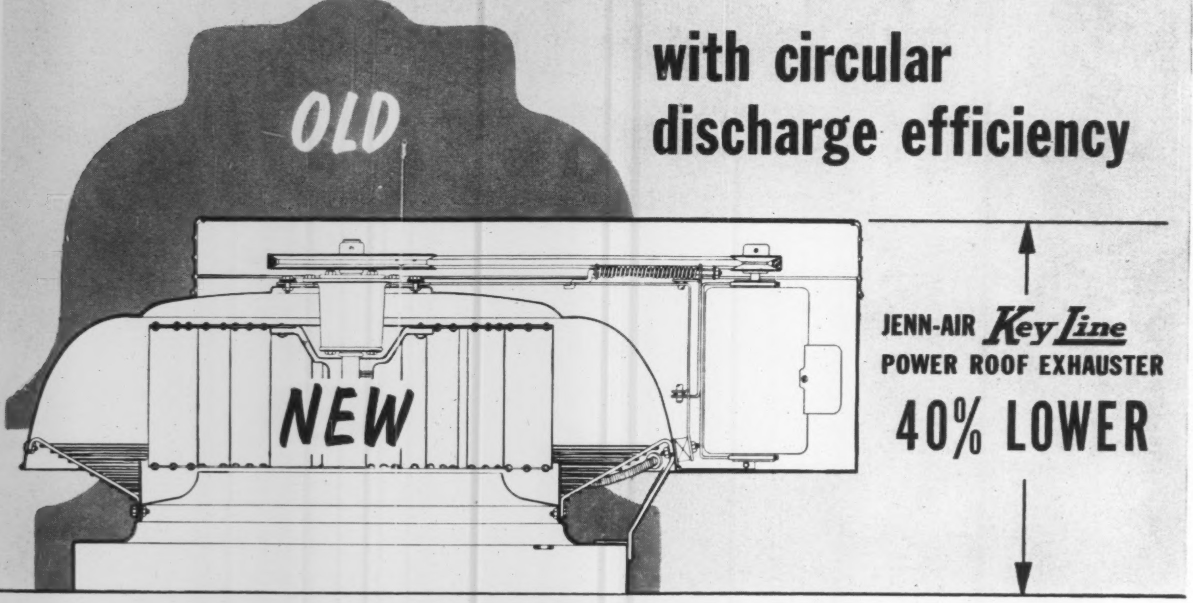
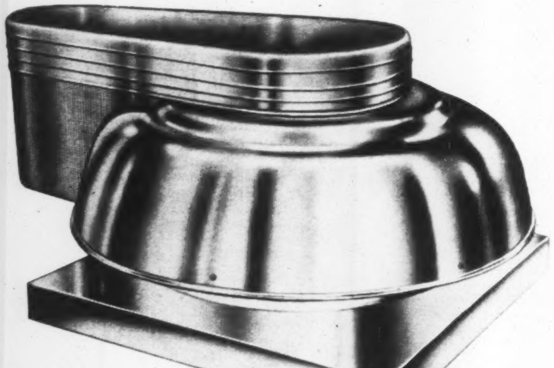
LOWEST CONTOUR OF ANY UNIT

with circular discharge efficiency



JENN-AIR *Key Line*
POWER ROOF EXHAUSTER
40% LOWER



Pat. pending

. . . and motor and drive are out of air stream!

Check these other KEY features:

- Maintenance-free spun aluminum housing
- Ten-year-lubricated ball bearing motor mounted out of air stream
- Drive with permanently sealed and lubricated ball bearings
- Heavy cast iron pulleys, adjustable to permit speed variation
- Belts with long drive centers for extra-long wear
- Automatic belt tightening device to assure constant fan speed . . . no service call-backs for adjustment
- Built-in bird guard
- Hinged curb for damper access (optional)

The Jenn-Air Key Line meets the most critical standards for styling, quiet operation and air moving efficiency . . . it's the key to better ventilation in any roof installation. Centrifugal or axial models. Capacities from 725 to 27,000 cfm. Write for Bulletins 60-CK (centrifugal) and 60-AK (axial).

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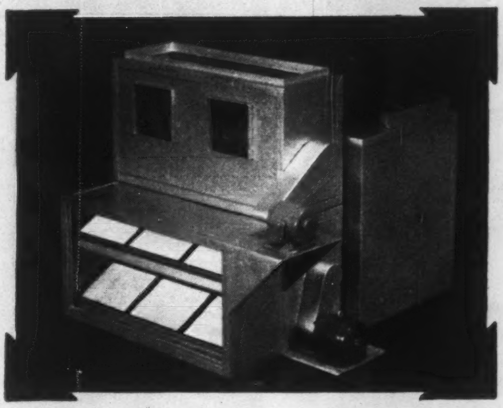

Dual Purpose Unit

IN THE BUENSOD FAMILY

of air conditioning apparatus

Although Buensod-Stacey is probably best known for its pioneering and development of dual-duct air conditioning system devices, that's not all we do. Far from it, the Buensod family of air conditioning products includes such items as Dual Purpose Units, air washers, automatic dampers, humidifiers and dehumidifiers, louvers, spray nozzles, and, of course, dual-duct and single duct units. Every one has been engineered to provide maximum on-the-job performance. There's probably a spot for Buensod equipment in your next installation. Write for complete information.

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If your job calls for sturdy fastenings to steel or concrete . . . for drilling or cutting concrete, masonry or tile . . . for multiple light fastenings to thick or thin ferrous and nonferrous metals, a talk with your OMARK representative is certain to prove worthwhile.

He will get together with you on the job or in your office, offer you sound counsel and service, come up with a ready, standard solution to your problem, or one quickly engineered to meet your specifications.

Either way, you will get helpful, dependable answers. Start now, with a call to your nearest OMARK factory branch. You'll finish the job with greater profit.

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DRIVE-IT® Powder-Actuated Tools — HAMMER-DRIVE and QUICK-DRIVE Manual Tools for Fastening to Concrete and Steel

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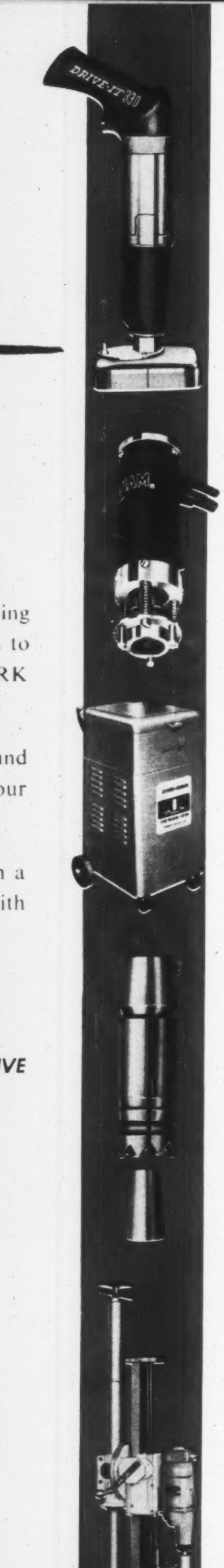

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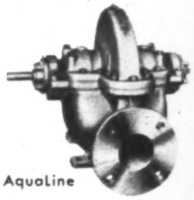
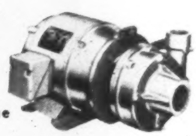

AquaLine


Fluidyne

PEERLESS AQUALINE® Pumps are available in sizes to 8-inches. Capacities to 2600 gpm, heads to 280 feet. Temperatures to 250°F. Horizontal split case design allows quick inspection without disturbing piping.

PEERLESS FLUIDYNE® Pumps are compact end-suction design. Redi-Packed in 22 sizes from 1 x 2 x 6 to 2½ x 3 x 10, for immediate shipment. Heads to 230 feet, capacities to 300 gpm, motors from 1 to 15 hp.

If there is a key word to describe Peerless Pumps, that word is QUALITY. You'll find it in the way the pumps are designed. You'll find it in the way the pumps are made. And you'll find it most apparent in the way these pumps operate. Remarkably long trouble-free operating records are routine with these better-made pumps.

But QUALITY is just the start of a long list of important features that recommend the Peerless AquaLine and Fluidyne line of pumps for your water handling jobs. There's immediate availability from ready-to-ship stocks. Complete hydraulic coverage for every type of application. Compact streamlined design that gives you space-saving good-looking layouts. And fast, on-time service from a network of warehouses and field offices. Get the full story of these superior pumps. Request more information today.

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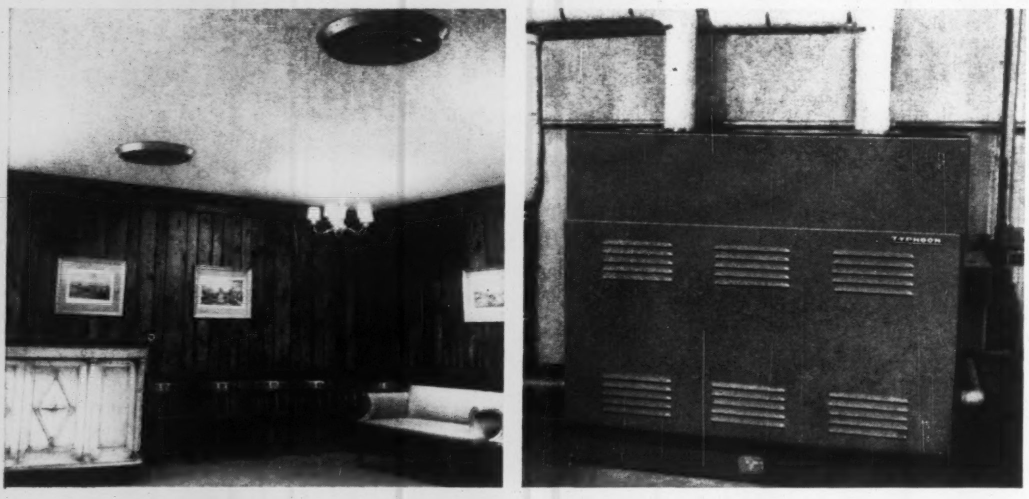
HPAC

FLEXIBLE TYPHOON PACKAGE UNITS SOLVE HOTEL'S COOLING PROBLEMS

New York's Warwick Reports Operating Costs Cut 33-50%



(ILLUS. 1) Three 8 ton units were installed—one for the second floor public room lobby and one for the Pine Room—the other for the Walnut Room. Two of these units were installed in the rear of the coat room serving this area, one was installed in the space next to the bar serving the Pine Room. The 20 ton unit was installed in the pantry next to the Warwick Room. Two 30 ton water towers were installed to provide condenser cooling water for the new package installation. (ILLUS. 2) A new 15 ton Typhoon package water chiller was installed operating on the old system with new controls, coils and piping to care for the smaller private dining rooms on the same floor. New individual smoke exhaust units were installed in each of the three rooms.

Talk about problems! The Warwick cooled 80 bedrooms and 5 public rooms with a central chilled water system. There were no individual temperature controls. The same coils were used for heating and cooling. During chilly spring or fall days, the bedrooms needed heat while the public rooms needed cooling. Even when only one public room was open, all five had to be cooled. Results: high operating costs; dissatisfied guests.

SOLUTION: Four Typhoon package units, to provide individual cooling and heating systems for the public rooms. Each unit was furnished with steam coils in the air discharge plenum, which were connected to the existing building heating system. A complete new duct layout was installed to improve air distribution. The bedrooms were then more efficiently served by the old system. ALL THIS WITHOUT USING INCOME-PRODUCING SPACE, THANKS TO THE COMPACTNESS OF TYPHOON UNITS. Operating Savings: 33 to 50%.

CONCLUSION: No matter how unusual or difficult your requirements may be, you can rely on Typhoon flexibility to fill the bill best at lowest possible price. For more information on the industry's most complete line of air conditioners, write today. Get your free copy of the 20" x 28" Reference Chart of the broad Typhoon line.

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☐ *Please send Reference Chart and full product literature.*
☐ *Please have representative call for appointment.*

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ADDRESS ______________________
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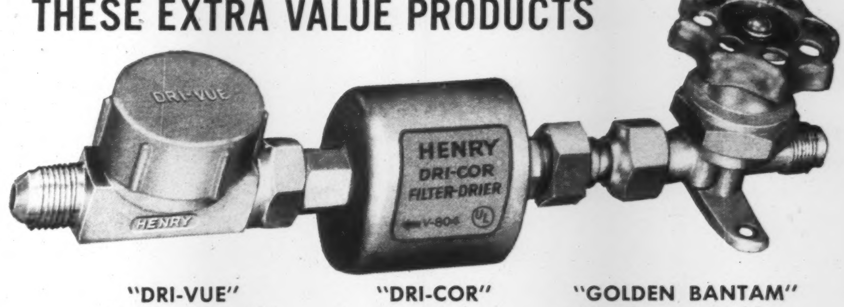
HENRY VALVE CO.

CONTROLLING FLOW SINCE 1914

DEMAND IS GREAT... EVERYONE IS BUYING THESE EXTRA VALUE PRODUCTS



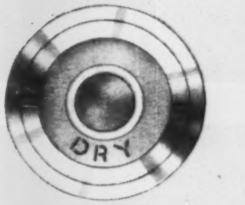
"DRI-VUE"
Moisture-Liquid
Indicators

"DRI-COR"
Filter-Driers
Molded Core

"GOLDEN BANTAM"
Diaphragm Packless
Valves

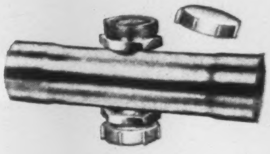
"DRI-VUE" INDICATOR PORT

Actually Spells "WET" or "DRY" with element Color Variation—Largest Visible Element Area.



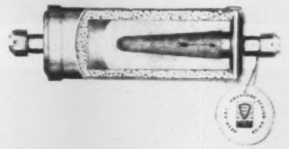
"DRI-VUE" INDICATORS

Double Port Moisture-Liquid Indicators, Large O.D.S. Sizes. Triple Sealed Ports.



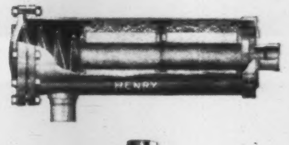
"DRI-COR" FILTER-DRIERS

Two Stage Drying; Molded Core and Granular Desiccant. Abso-dry Processed.



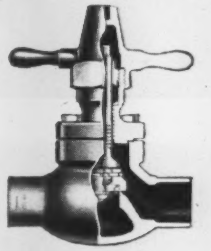
"DRI-COR" Cartridge DRIERS

Molded Filter Core and Granular Desiccant. Split Second Cartridge Installation.



SHUT-OFF VALVES

Packless and Packed with Flanged and Integral Connections. Wide Range of Sizes and Types.



Only Henry offers you this complete variety of types and sizes, from 1/4" flare packless to 4 1/8" O.D.S. packed Wing Cap valves, from 1 ton sealed type to 165 ton cartridge type filter-driers and 1/4" flare single port to 2 1/8" O.D.S. double port moisture indicators.

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For Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILLINOIS, U.S.A.   CABLE: HEVALCO, MELROSE PARK, ILL.

Motors and Generators ... that's our Business!

ME*

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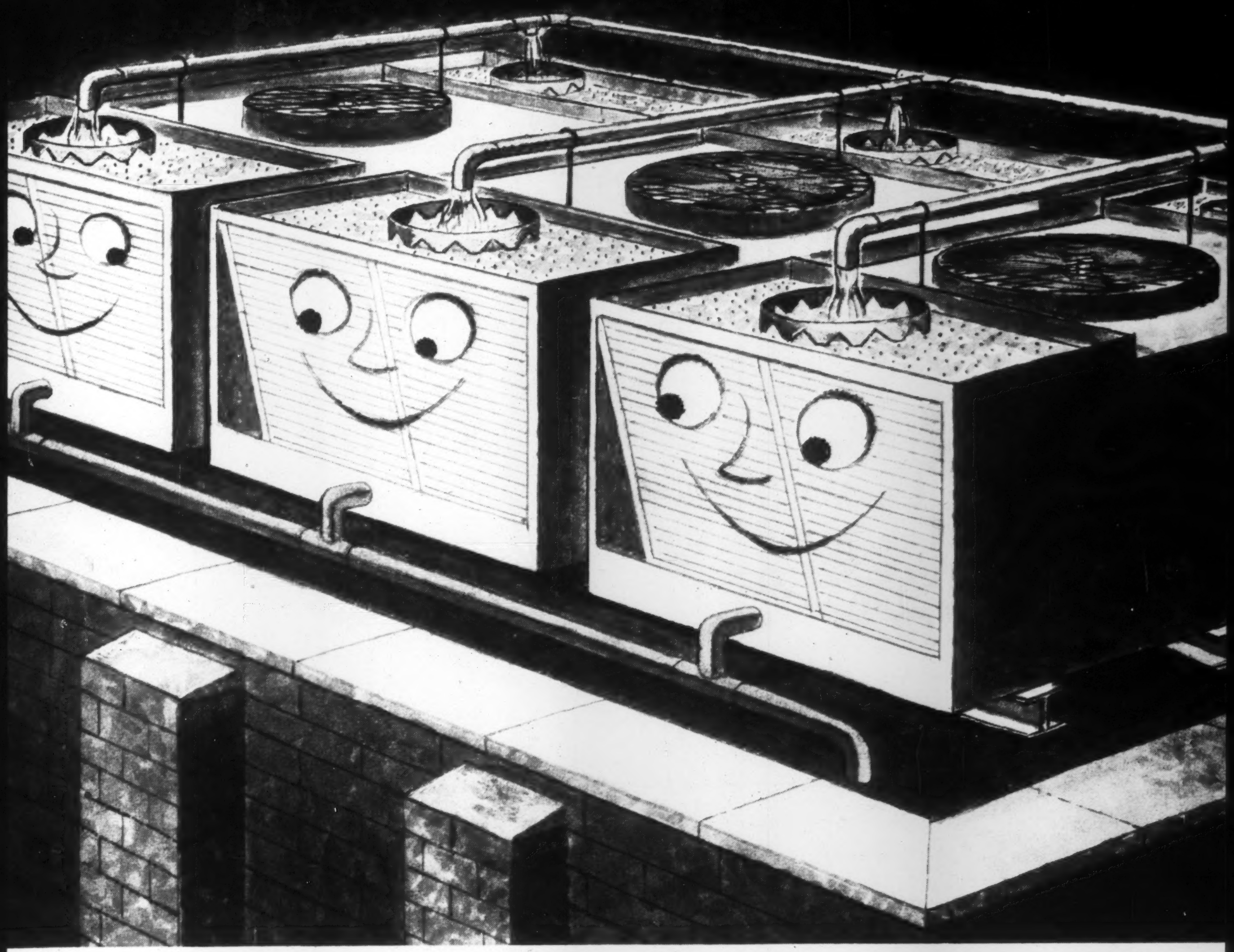

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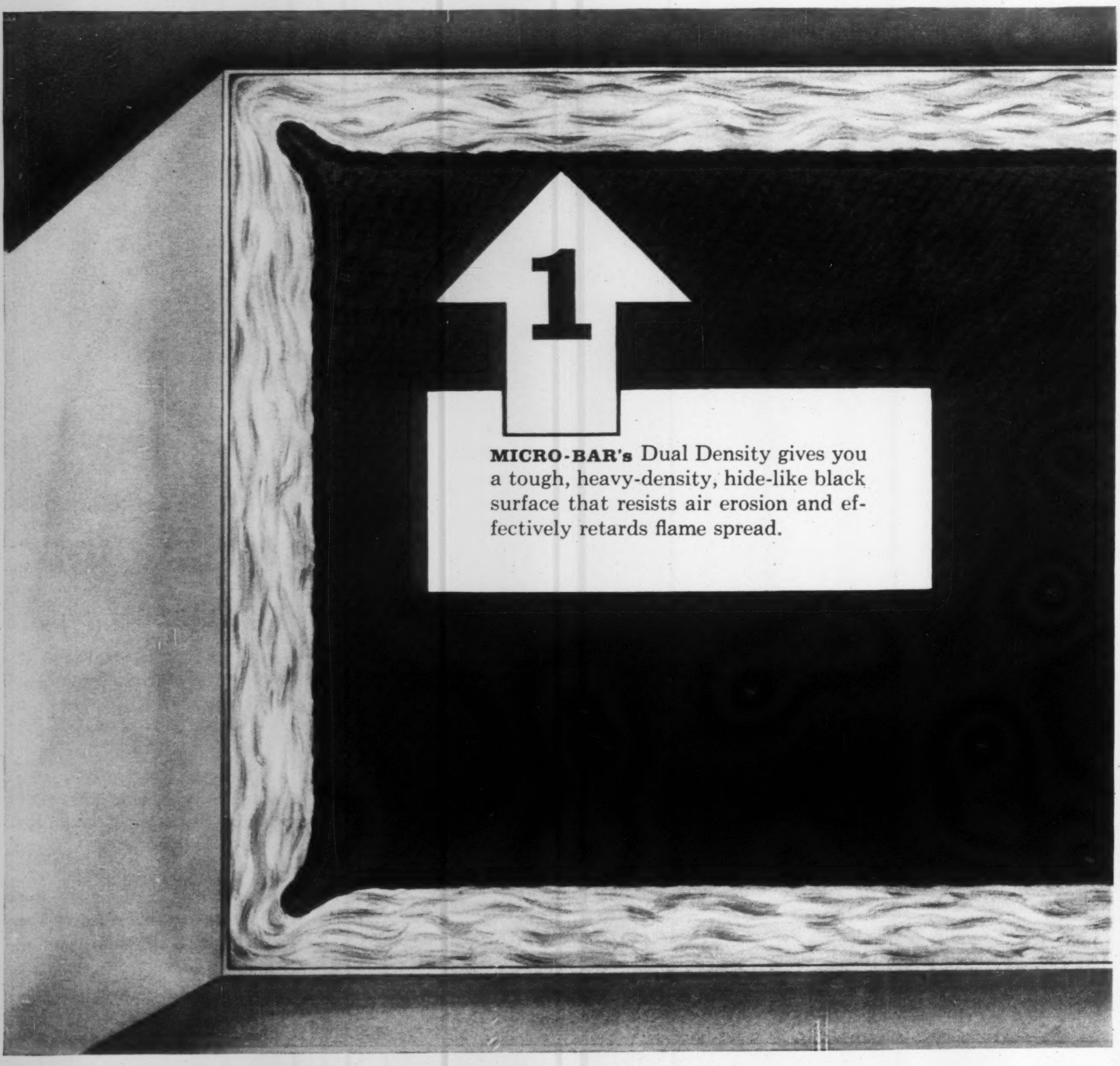

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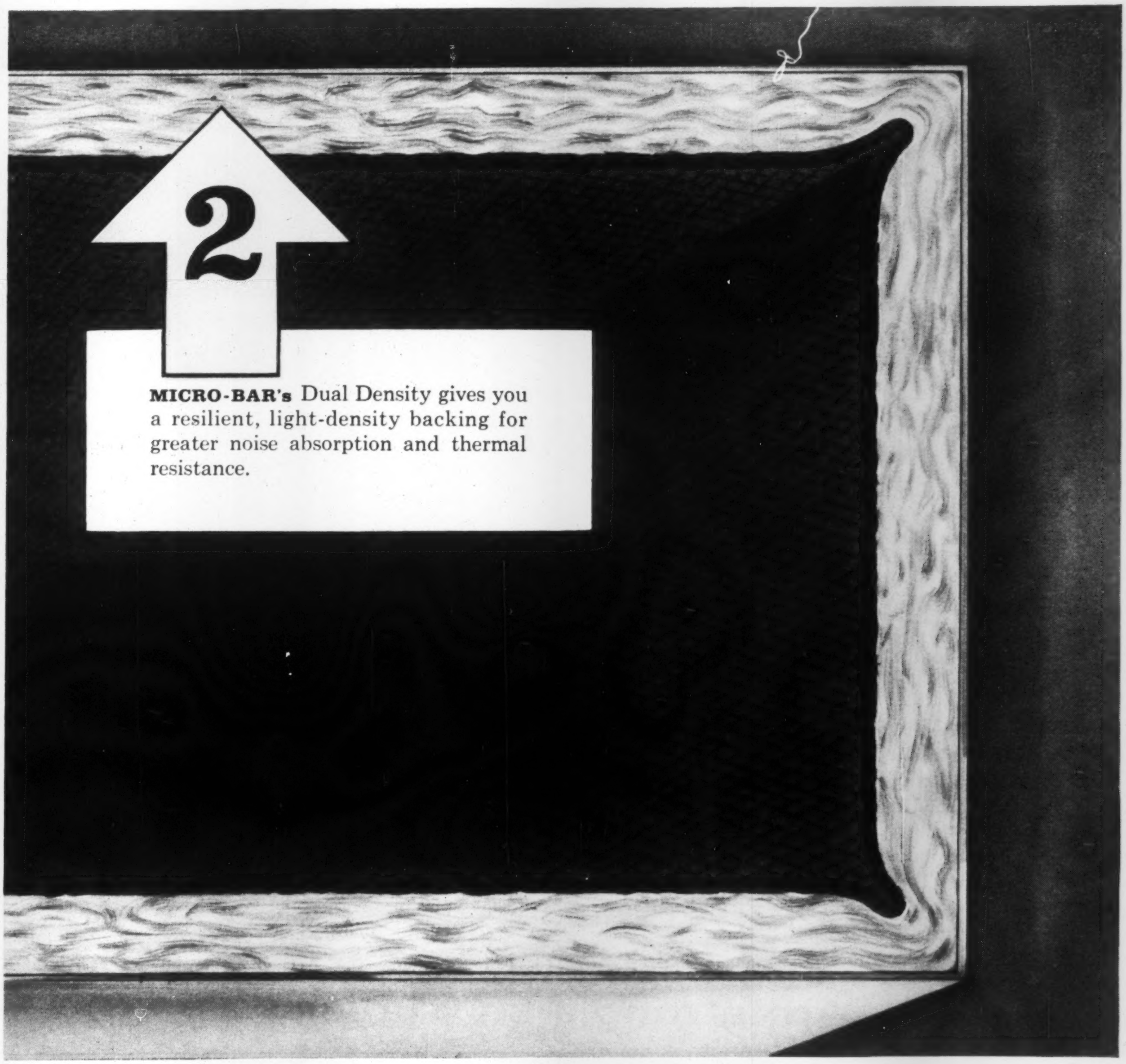

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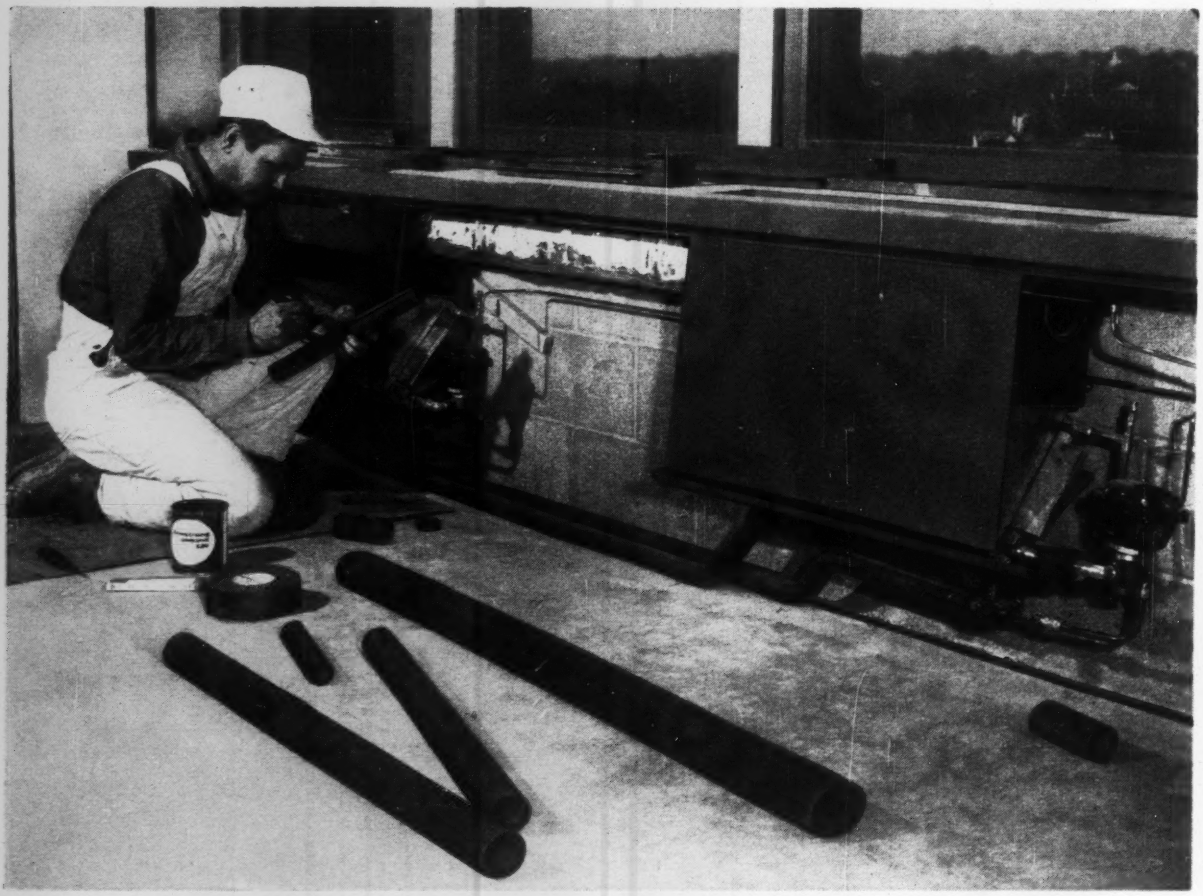

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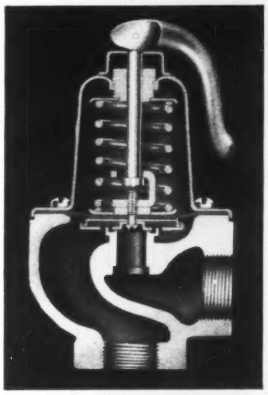

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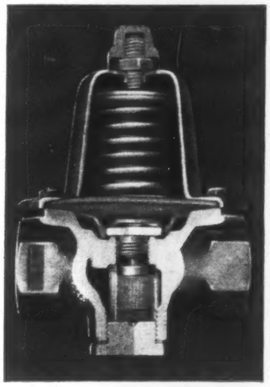

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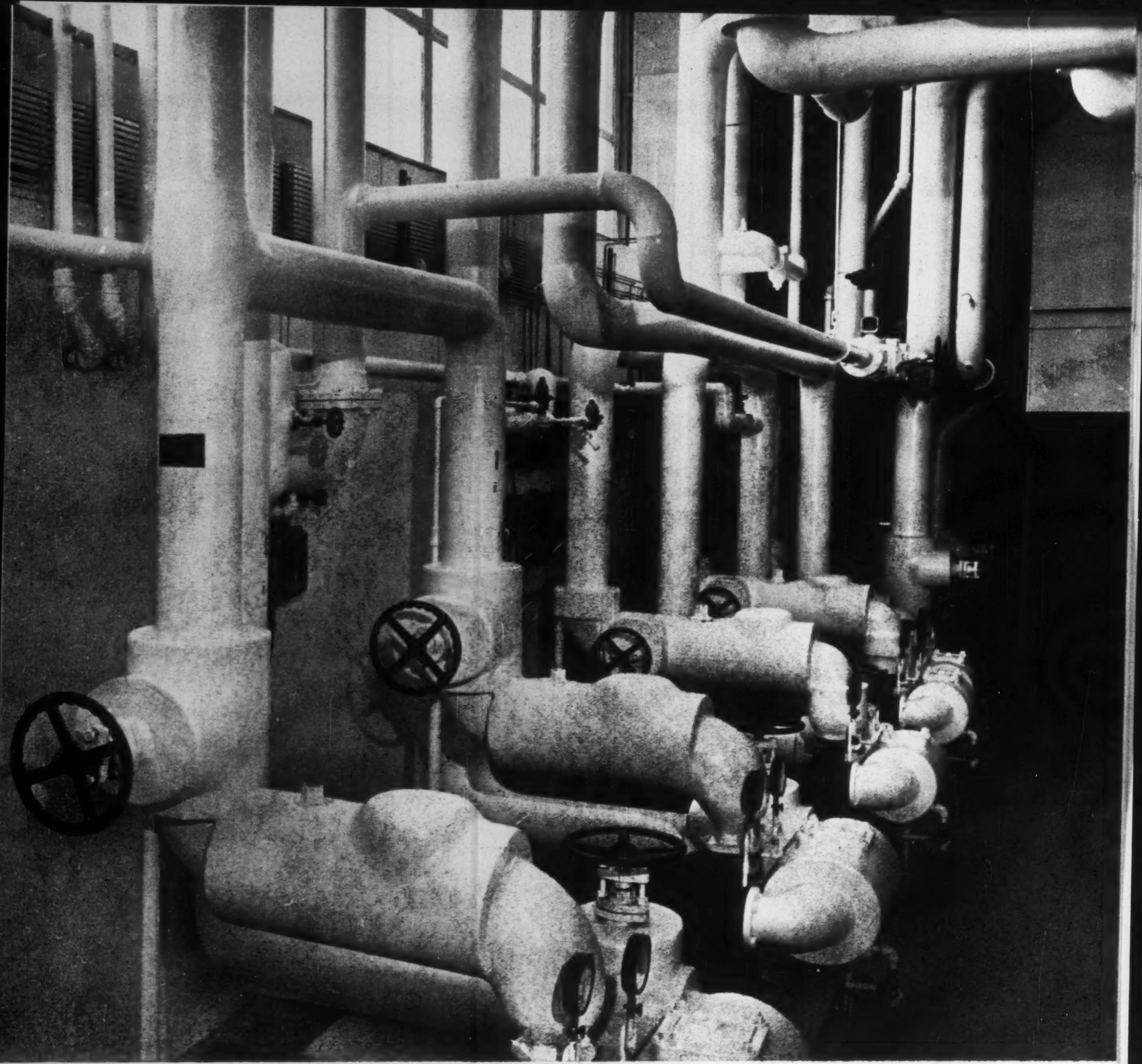

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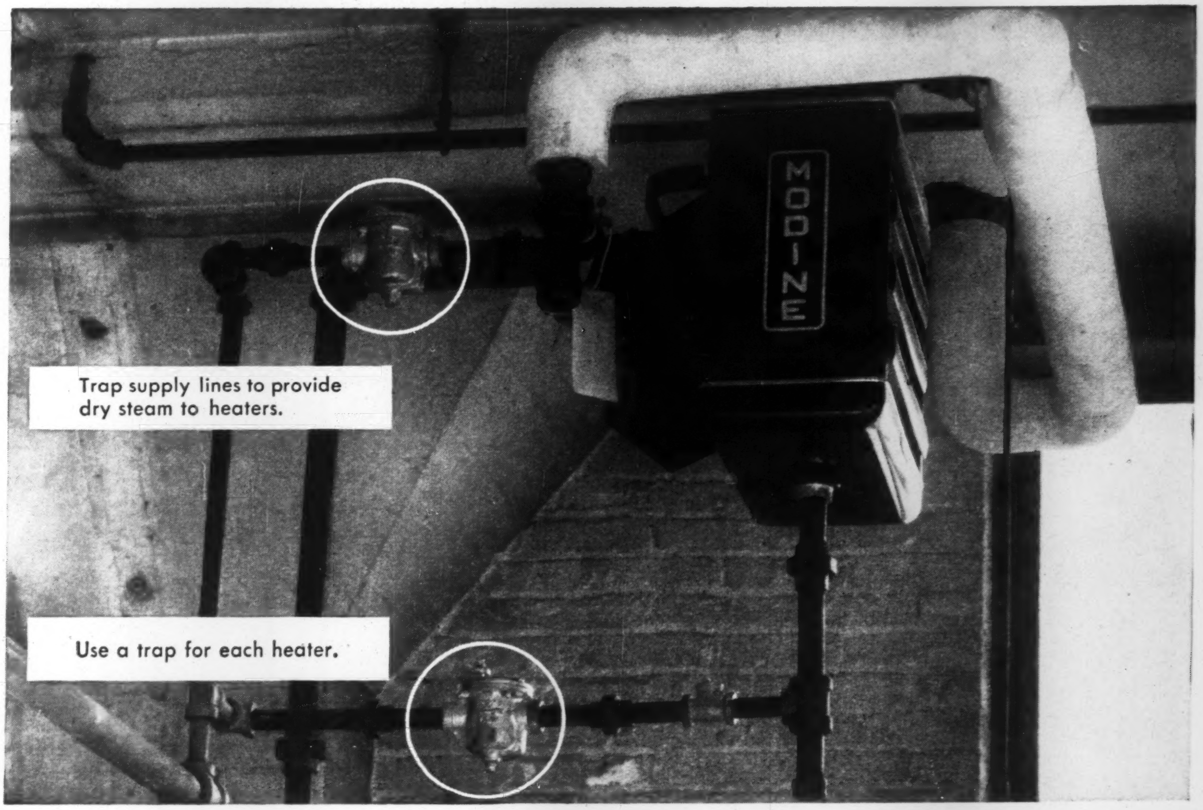
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1. Trap supply lines to take care of condensate formed by radiation loss.

2. Use one trap for each heater. Two or more heaters drained by a single trap will fail to deliver maximum btu output.

3. Size traps properly. Many a unit heater is handicapped by a trap lacking adequate condensate and *air* handling capacity. The few dollars extra for larger traps insure fast heatup, full output and freedom from coil corrosion.

4. Install traps correctly. Put trap below and close to heater. Install a bypass around the trap if the heater must be kept in operation at all times. A shut-off valve in the discharge line facilitates trap inspection. Use of check valves and strainers is dependent upon piping conditions and the traps used.

5. Protect against PRV failure where freezing could occur. Sometimes heaters supplied with reduced pressure steam are installed where freezing could occur if traps failed to open. In this case select traps that will open at maximum steam supply pressure and still have adequate capacity at reduced pressure.

FREE ON REQUEST—COMPLETE INFORMATION on the above points, diagrams, selection data, tables and additional recommendations are contained in Armstrong Bulletin No. 252. Also includes BTU output ratings for all models of 30 makes of unit heaters. Call your local Armstrong Factory Representative or write direct.

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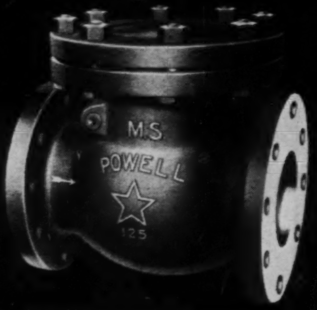

Fig. 559—Iron body, bronze mounted swing check valve for 125 pounds W.S.P. Regrindable, renewable bronze seat and disc.

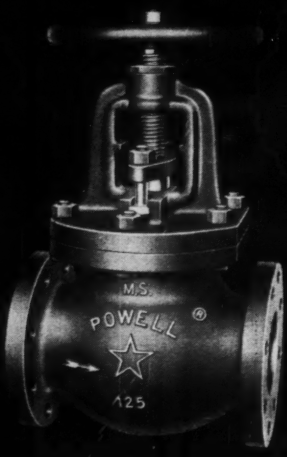

Fig. 241—Iron body, bronze mounted OS&Y globe valve for 125 pounds W.S.P. Regrindable, renewable bronze seat and disc.

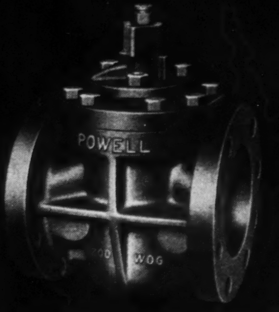

Fig. 2201—Large 200 pound W.O.G. semi-steel lubricated plug valve. Bolted Gland Type.

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You Can Install Flexible Connectors Either Horizontally or Vertically

THE ARTICLE, *Flexible Connectors Cut Installation Costs of Tall Building Heating*, by Lewis Smith (March), is of great interest. I believe heating, piping, and air conditioning engineers and contractors are finding this to be especially helpful.

It seems to me that there is an error in choice of words on page 118 with reference to the word "lateral." This usually refers to horizontal movement, in my opinion, and in this case it should be "axial" or "longitudinal" since Mr. Smith is trying to bring out the fact that these sections do not act like an accordion but are designed to permit movement perpendicular to the axis of the connector.

While it is not so stated, I feel certain that Mr. Smith was assuming that these connectors would always be installed horizontally, and therefore the vertical pipe section (riser) would do the moving. This would be true in the applications he describes.

Actually, a flexible section can be installed either vertically or horizontally depending upon which direction the anticipated movement is to occur. One end is fixed with a solid anchor while the other can move perpendicular to the axis of the connector.

J. SPACHNER
Vibration Mountings, Inc.

Controlled Competitive Bids Get Favorable Cost for the Customer

THE ARTICLE, *Should the Low Bidder Get the Job?*, by E. W. Klein, Jr. (April), brings out the unfair shopping for subcontractors by general contractors and points out the lack of consideration for the subcontractor's reputation. While we agree that this practice is unethical, we still believe that competitive bidding is desirable in order to obtain a favorable cost for the customer. The obtaining of a favorable cost, of course, should not be done on the basis of providing the customer with an inferior job.

In order to insure a satisfactory job, we have set up a bidding procedure on new work which gives a fair measure of control, at the same time obtaining competitive bidding. Both our mechanical and electrical work is put out directly to selected lists of reputable mechanical and electrical contractors.

The bids are received directly in our office at the same time as the general contractor's bids. The successful mechanical and electrical contractors are then selected by our office together with our client. They are assigned under the general contractor, so that the general contractor is still responsible for the entire project. The general contractor receives a management fee for coordinating the subcontractor's work. This fee is determined by the general contractor along with his bid. In this manner, we can control selection of the mechanical and electrical bidders to be sure of only reputable firms of adequate size to handle the particular project.

There are a number of refinements which are necessary in order to assure that the system will function properly. First, in those areas where we are not acquainted with mechanical and electrical contractors, we go through a qualifying investigation for each contractor before we place his name on the approved list. The list of general contractors, mechanical contractors, and electrical contractors is available to each contractor bidding.

If any general contractor does not wish to work with a particular mechanical or electrical contractor, he can so qualify his bid. Likewise, any mechanical or electrical contractor can qualify his bid in that he will not work with a particular general contractor. Any such qualifications are then taken into account in selecting the successful contractors. This procedure has been used on work from coast to coast and has been satisfactory. By a careful selection of the bidders, the quality of the work can be retained while still obtaining cost advantages of competitive bidding.

This system does not control the equipment to be provided by the mechanical or electrical subcontractors. So "shopping" can still result in the placement of orders for material and equipment by the successful contractors. In order to reduce this and maintain proper quality under an "or approved equal" type of specification, the apparent successful mechanical and electrical subcontractors must submit a list of the proposed manufacturers of all major items of equipment before the contract is actually awarded.

If the subcontractor proposes to use equipment of a manufacturer which is not approved, he is given an opportunity to submit a revised list of manufacturers. The detailed approval of the exact models of each approved manufacturer's equipment is handled in the normal manner after award of the general contract and the subsequent award of the subcontracts. Generally, this procedure avoids the shopping among suppliers by the subcontractors and insures that the equipment proposed will be reasonably equal to that specified.

While the scheme described above does not eliminate all of the ills of competitive bidding, it minimizes these and assures the client of full value for each dollar expended.

R. R. Kirkwood
Partner
Director of Mechanical and Electrical Engineering
Seattle Office
John Graham and Co.

Engineering Data File on Dampers Is Welcome Addition to Literature

The literature contains much uncorrelated information pertaining to damper selection and sizing, but the HPAC Engineering Data File, *How to Select Multiple-Leaf Dampers for Proper Air Flow Control,* by Edward J. Brown (April), puts together existing and new data into a usable single package. Comparison of the various data helps to fix facts in the mind of the reader.

Dampers are absolutely necessary in practically all systems, except possibly some very specially designed single-purpose dust collecting systems, but they should not be used to compensate for poor duct design.

The design engineer should always keep in mind the principle that his work consists of designing for transient and not static systems. Air volumes, pressures, temperatures, and densities are constantly changing in response to controls. Therefore it is imperative that the selection of dampers be understood sufficiently so that their performance can be analyzed under varying operating conditions. Selection based on steady-state conditions represents only handbook engineering.

Mr. Brown's section on mechanically linked dampers is particularly good. Such damper combinations are very common, but it is doubtful if very many analyses are made of flow under conditions other than full diversion to one duct or the other.

The author's work on dampers in combination with a blanked-off section is certainly welcome. This information should add some accuracy to the selection of face and bypass damper components. I am sure that most engineers take into account the need for a balancing pressure drop in designing the bypass. Now we have a means of accounting for the pressure drops due to contraction as well as expansion.

Even though some of these refinements may produce negligible results, an understanding of their existence is important to the professional engineer. A time always arrives when a thorough understanding of basic principles is needed. Articles such as this one by Mr. Brown contribute greatly to this understanding.

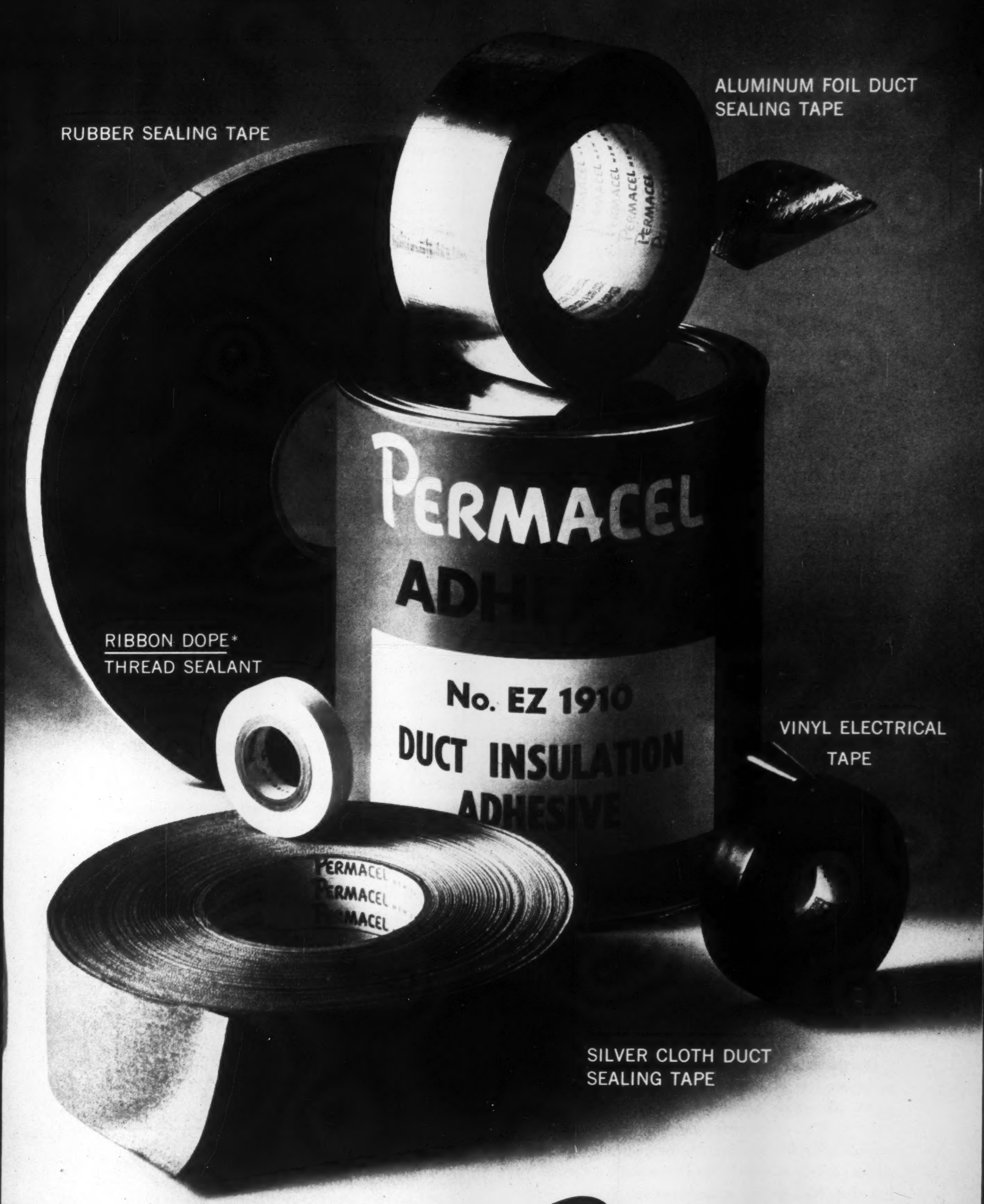
W. S. Maxim
Chief Mechanical Engineer
Abbott Laboratories

Evaporative Cooling Data File Slights Industrial Applications

The HPAC Engineering Data File, *Evaporative Cooling — When and How to Use It* (March), is a carefully-presented and well-documented article highlighting many of the uses of evaporative cooling. The bibliography has been well-used to correlate the pertinent information on this subject. The article should prove a useful review for those of us engaged in air conditioning and should be a good text for students as well.

Unfortunately, two phases of evaporative cooling have been omitted from this study. In this article, which emphasizes the human comfort features of evaporative cooling, no reference is made to those many industrial applications where the prime requirement is to maintain a fixed relative humidity in the treated space with minimum regard for the dry bulb temperature and personnel comfort.

A typical example of where evaporative cooling can be used advantageously for this purpose is in mixing rooms or cement houses where chemicals or compounds are blended with volatile solvents. Considerable danger is experienced in these applications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due to the possibility of static discharge within the space. Even with the use of grounding bushes, the explosion danger still exists. The maintenance of a relative humidity of 50 percent or more considerably reduces the chance of dangerous static discharge.

Evaporative cooling used as described in the article can readily maintain any desired relative humidity throughout the summer months. With the inclusion of heaters, it can provide constant dry bulb and relative humidity conditions throughout the winter months.

The article also overlooks the use of evaporative cooling in conjunction with a complete mechanical refrigeration system. In such an application, the water sprayed on the air during the peak load period is, of course, chilled by the refrigeration equipment. During those periods in the spring and fall when the outside wet bulb condition is sufficiently low, the desired room conditions can readily be maintained without operating the mechanical refrigeration equipment. This arrangement in no way reduces the size of the refrigeration equipment required, but it does reduce, by many hours during the year, the time during which it must operate.

There is also no mention in the article of the use of direct sprays within the room. These, of course, are normally considered humidifiers, but in effect they are evaporative coolers serving a distinct purpose. Their use can permit radical reductions in the amount of air to be circulated by the central evaporative cooling equipment. The best example of the desirability of using room humidifiers might be a cotton weave shed where humidities as high as 80 percent are desired. If a system using a central station evaporative cooling unit is employed without the use of room sprays, a very large volume of air is required, as the available temperature rise is limited to approximately 5 F.

Despite the tremendous concentrated heat load within the weave shed, the air volume required can be reduced to less than half by the use of room sprays which are frequently selected to add as much as 13 grains of moisture per lb of dry air. For example, with an outside wet bulb of 75 F, and an assumed efficiency of 100 percent in the evaporative unit, the room condition would be approximately 81½ F and 80 percent RH without room sprays—allowing a total temperature difference of 6½ F.

On the other hand, if 13 grains of moisture per lb of dry air is added by direct sprays within the room, the room condition becomes approximately 84½ F, 80 percent RH, and the temperature rise available for the air through the central evaporative cooler is approximately 18 F, permitting the use of less than half the air otherwise required.

There are many industries for which evaporative cooling is all that is needed to satisfy the requirements of a product. The personnel within these conditioned areas benefit, to some extent, thereby. Mechanical refrigeration could, of course, maintain desirable product conditions with a considerable increase in employee comfort. But in many cases the additional advantages of mechanical refrigeration can be realized only at an economic cost out of proportion to the value of the product.

Joseph H. Burges
Engineer
Air & Refrigeration Corp.

Piping Stress Analysis Article Draws Thought-Provoking Comments

I HAVE two sets of comments to make relative to the article, *How to Write, Use a Computer Program for Calculating Pipe Stresses*, by T. E. Bridge (March). In the first place, I echo Mr. Bridge's wish for better information available regarding the permissible force and moment reactions which piping may impose upon terminal equipment. In this we join a throng.

In his paper, *Piping Flexibility Analysis* (ASME Transactions, February 1955), A.R.C. Markl summarizes information and opinion which was available to and was studied by the Flexibility Task Force of the ASA Committee on the Code for Pressure Piping. In addition to the many references which Mr. Markl cites, two more which are worthy of mention are General Electric Co.'s *Steam Piping Systems Connected to Turbines*, and a similar publication issued by Westinghouse Electric Corp.

Every turbine of any appreciable size made by these and other manufacturers comes with a file of data which includes information on permissible reactions. In many cases this information is available long before the turbine itself, and the piping designer had better conform to these recommendations or be well-prepared to argue with them.

Incidentally, some manufacturers of boilers and turbines will cooperate in making modifications to structural supports, etc., so as to accommodate larger reactions than they originally recommended; this may involve additional equipment cost, but it may be less than the cost of additional piping to provide greater flexibility.

The point I wish to make is that the standards put forth by Mr. Bridge are just one set of criteria among many others. If they are better than others, *why* are they?

Editors' note: These paragraphs from Mr. Bridge's article are repeated below:

"After studying the rules in the NEMA code for mechanical drive turbines, and based on our own experience, I would like to propose the following standard as a rough guide until we get something better.

"1) For mechanical drive turbines and centrifugal gas compressors:

$$F = 50\,D$$
$$M = 300\,D$$

where:

D = nominal diameter of the pipe connection to the turbine, in.
F = allowable thrust of the pipe on the turbine, lb
M = allowable resultant bending moment on the turbine, lb ft.

"2) For pumps designed for high temperature with centerline supports, multiply the value obtained for turbines by 5.

"3) For all other rotating equipment, keep the bending stress in the pipe at point of attachment to the equipment below 4000 psi. For the purpose of this calculation, assume the pipe to be the same size as the nozzle to which it is connected.

"4) For boilers, heat exchangers, tanks, etc., keep the bending stress in the pipe at point of attachment to the equipment below 5000 psi. For the purpose of this calculation, assume the pipe to be the same size as the nozzle to which it is connected."

Mr. Bridge's item 1 is in the same small ball park as most of the other criteria. I am not prepared to comment on his item 2. His items 3 and 4 appear to be rather unnecessarily restrictive; it is fine if a suitable system gives rise to stresses only this high, but to hold stresses down to this level may require uneconomically conservative design.

Another point which should be made in this connection is that when some manufacturers talk about allowable reactions they mean just that, while others mean rather allowable reaction ranges. These two things are not the same if other than 100 percent coldspring is used in erection, and it is wise to have a clear understanding of what is intended before the design or analysis proceeds very far.

The second set of comments I have to make is in regard to writing and using a computer program at all. Several years ago it became apparent that the advent of high speed automatic digital computers meant that the very difficult task of making accurate flexibility analyses of complex piping systems could now be handled expeditiously. A number of different persons and groups went to work devising computer programs to do this. A series of three articles was published in the May, June, and July 1957 issues of Heating, Piping & Air Conditioning in which I mentioned a number of such programming efforts and gave some details of my own program which had been operating since the summer of 1955. Some of the other efforts have come to full fruition and still others have withered on the vine.

My program was not the first and is not the last; for a while, in my opinion, it was the best, but this is no longer so. Now there are several programs which are so flexible, so fast, so readily available, so inexpensive to use that it is very hard to imagine circumstances under which it might be profitable for the piping engineer, even the specialist in piping flexibility analysis, to go through the effort and agony of devising yet another piping flexibility program.

The best and least expensive programs are for the fastest computers. I know that the IBM 704 program devised by the Service Bureau Corp. is fast, flexible, accurate, and reliable and that the input is dead simple. This is the program I use now in preference to the one I devised several years ago for the NCR 102A. It is far cheaper for me and my clients to send problems to the Service Bureau Corp. than it is to do them myself. From all that I have heard, the IBM 704 program of the Electric Boat Div. of General Dynamics Corp. is just as good and reliable, although I believe that the costs are somewhat higher; I have not used this service myself. The Blaw Knox-Arthur D. Little program is a commercially available program which has been rather widely used. For a while it had some bugs, but these are probably gone by now. Also, there is a new General Electric program devised by Lela M. Keough for IBM 704 and available to SHARE members. This one still has some minor output bugs, but it would appear that these will be quickly cleared up. Besides that, the M. W. Kellogg Co. still offers its flexibility service. And there are several others.

Devising a new piping flexibility program is a whopping big job — to devise a program that has all the organ stops that are possessed by those which I have mentioned above is a job of still greater magnitude. Programming costs money — overhead and salary for the highest grade piping engineers and computer programmers. In my opinion, this cannot be justified at all in view of the very nominal charges made for flexibility analysis by any of the groups and enterprises I have mentioned. Unless input and output routines are very complete and flexible, it will cost more to do the job yourself at home — not even counting the cost of the computer or of the programming effort — than it will to send the job out. It does not take elaborate overhead cost accounting schemes to show this.

I certainly do not want to sound as if I am discouraging small companies (and large) from the idea of getting digital computers appropriate to their own individual needs for accounting and scientific purposes. But do not fool yourself about their usefulness in piping flexibility analysis. You can, with great effort, write a program which will do the job. But don't try it. Unless circumstances are quite unusual, it will be cheaper to have someone else do the flexibility analysis. For example, even though your shop has a lathe, it is generally better to buy your machine screws from a jobber than it is to turn them out in the basement.

All this is not to say that there is no further need for programming effort for piping flexibility. But leave this up to the persons directly involved with the high speed, hotshot efforts such as those I have mentioned. The laws of economic competition being what they are, better mousetraps are in the process of being built. If you don't find the service or the special output information that you want, tell these people about it. Unless your circumstances are very, very special, it would cost you more than it is worth to do it yourself.

If you are going to mess around with a computer — and I think most engineers should become acquainted with this most useful and most important engineering tool — address yourself to some new problem that is not already well in hand. How about flange design? Pressure vessel heads and supports? Heat exchanger design?

Incidentally, it might be of interest to mention briefly how computer programming of the future probably will be done — and this should serve to encourage those who are dismayed by the fact that all computers seem to be different from one another and must be addressed in different languages with different intonations. The hottest of the computer hotshots are devising (in fact, have pretty well completed) a universal computer language called ALGOL. At present, this is not fully compatible with some of the more important computers, but it may be expected that compromises of one sort or another can be worked out. When this is done, the programmer of a truly big and important problem will write his program in ALGOL and it will be a mere detail for one of the big machines to translate this ALGOL program into a machine language program for itself or possibly for another computer.

I anticipate that the evolution of computer analyses of many important engineering problems will proceed as follows:

First, there will be several independent programming efforts, using possibly different mathematical procedures to accomplish the job.

Second, by word of mouth, discussion, and correspondence, the more promising of these approaches will be recognized and there will be evolution of the theory along these lines.

Third, sparked by economic considerations such as the incidence of a large number of problems yelling to be solved or encountering a problem the complexity of which taxes the existing programs, computer hotshots and engineers will get together to devise highly flexible and sophisticated programs for the fastest and best machines available.

Fourth, goaded by competition, by the development and use of faster and better machines, or by the disclosure of new and important facets of the problem, there will be reprogramming in the most modern and exotic ways available at the time. The piping flexibility problem has passed through stages one and two, and is just now emerging from stage three. Stage four and its sequels are for the future — but with computer technology and computer programming, the future arrives before you know it.

JOHN E. BROCK
Professor of Mechanical Engineering
U. S. Naval Postgraduate School
and
Consulting Mechanical Engineer

THE AUTHOR'S REPLY—Although I think that Dr. Brock's points are well taken, I would like to answer two questions that he asks, i.e., (1) Since every turbine of any appreciable size made by these and other manufacturers comes with a file of data which includes information on permissible reactions, why do I propose a rough standard of allowable reactions?; and (2) Why am I spending the time to write a computer program when others before me have done a more thorough job than I can hope to do?

I think that the key to the apparent difference in point of view will be found in his words, "every turbine of any appreciable size." Dr. Brock is concerned about the large multi-million dollar turbines found in central station installations. I have been concerned with the hundreds of small pumps, turbines, heat exchangers, centrifuges, filter presses, and other related equipment found in any chemical plant or oil refinery.

First question: Dr. Brock apparently belongs to the power fraternity. They do not need my proposed standards. These people, largely by themselves, have pioneered the development of pipe stress analysis. Years ago, the large turbine manufacturers understood the problem and were prepared to set limits for pipe reactions on their equipment. This is not so for the bulk of equipment that is installed in a large refinery or chemical plant.

Many plants are completely designed before procurement is started. Pumps and turbine drives are faked in from catalog cuts and the piping is completely designed before the drawings are turned over to a separate firm who does the procurement and construction. This latter firm prepares as-built drawings after the procurement is completed. Many government contracts are negotiated in this manner.

When you contact individual small turbine companies, pump companies, and manufacturers of other mechanical equipment and ask about allowable pipe reactions, many of them will say "zero." But the piping engineer knows that this is not possible.

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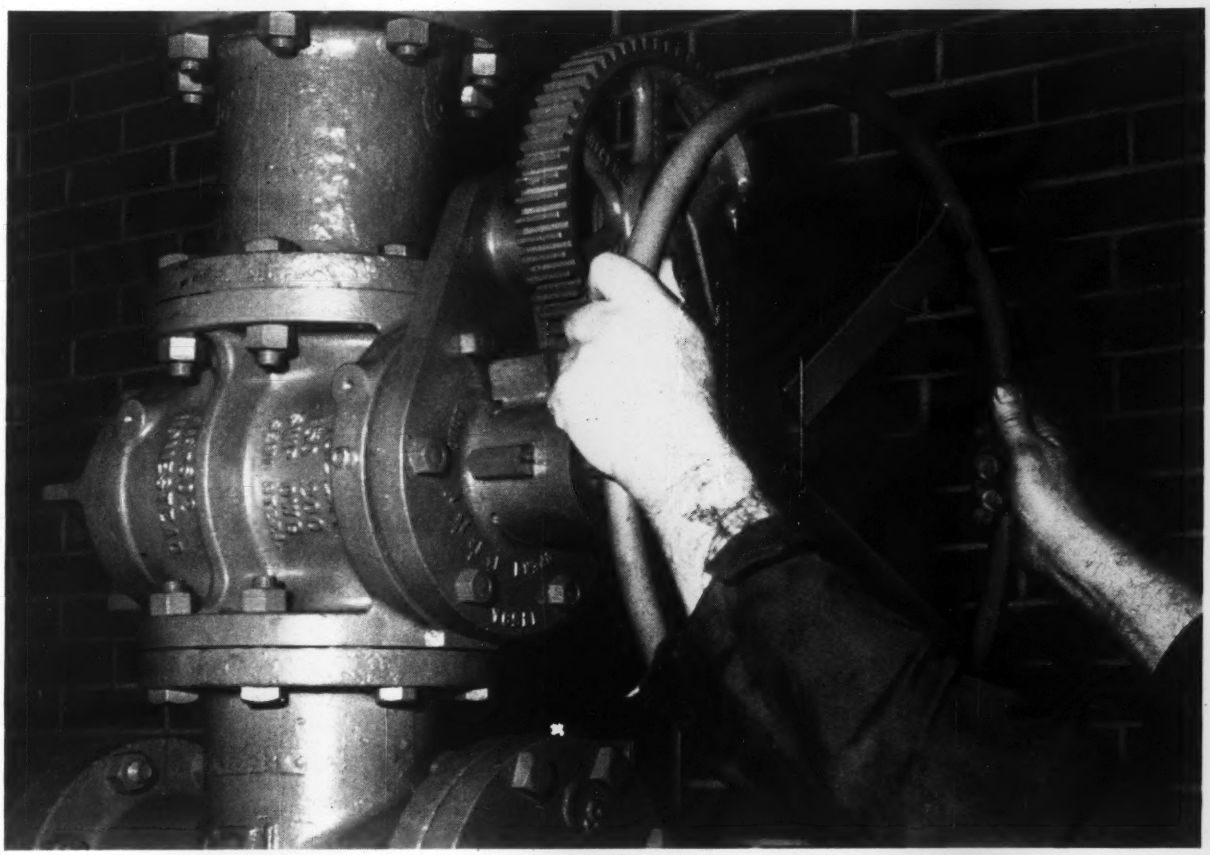

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drawings to be released along with specifications for procurement and construction. You must formulate some standard in your mind to decide whether the piping has the required flexibility.

Second question: The answer to this question is twofold:

1) I *like* to do it.

2) The cost of having your pipe stress work done on a big machine with somebody else's program should be cheaper than to develop your own program. But when I checked prices three years ago, the costs were prohibitive.

If a turbine costs several million dollars, you can afford to spend a thousand dollars to analyze the stress in a single piping lead. But if you are checking out piping drawings connecting 50 or more small pumps with turbine drives scattered over a wide area, you have to do a lot of thinking about the cost of analyzing pipe stress. If, in addition to the steam piping, you are concerned with a very large amount of hot oil and molten metal piping, you do still more thinking.

A Royal McBee computer can be rented for $25.00 an hour a few doors down the street from the main office. About three hours once a week should be adequate to handle nine or 10 of the three and four-anchor problems that make up most of our work. This is a far cry from the $700 for the minimum problem that was quoted to me about three years ago. It is quite possible that the Service Bureau Corp. rates for pipe stress work have come down appreciably since then. I hope they have.

We have been guessing at pipe stresses for a long time and have never had a failure. No doubt, we use more pipe than is always needed. We must make our piping more flexible than would be required if we could figure it out carefully. But you cannot spend more money for the analysis than the whole piping system is worth.

I am currently engaged in debugging a pipe stress program for the Royal McBee LPG-30 computer with the help of Donald Weaver of TVA. Mr. Weaver now does the pipe stress work for the TVA on an IBM 704 computer operated by the TVA in Chattanooga. Even though he has a 704 available, he would like to use the LPG-30 that sits in the next room, rather than wait for the transmittal of data and answers by mail from a distance of about a hundred miles. I think that we can work out a simpler input data sheet than the one he is now using. But most of all, I think we both want to learn more about computers. The language of the 704 was too difficult for me to learn without going to school. The Fortran language is easy to learn, but appears that it would cost a lot of money to debug a complicated program written in Fortran. I was able to learn the language of the LPG-30 in two hours.

Anyone who has ever come face to face with the overpowering drudgery of a multi-anchor pipe stress problem really gets a thrill when he watches a machine take off on one of these problems. When the layman watches a machine working, he just sees a lot of flashing lights. When we watch the machine, we are more aware of what it is doing. We can feel the tremendous power of the machine; we get a glimpse of the future.

Dr. Brock wonders why we do not work on some other problem — as for example, heat transfer. These other problems have also been programmed by people more able than us. We have to work in the field we know. For me, the writing of a pipe stress program is a wonderfully absorbing hobby that ties in with my past experience and my hopes for the future. I want to learn all I can about computers in the only way I can — by working on one.

I am grateful to Dr. Brock for his excellent comments.

Theodore E. Bridge
Piping Design Consultant

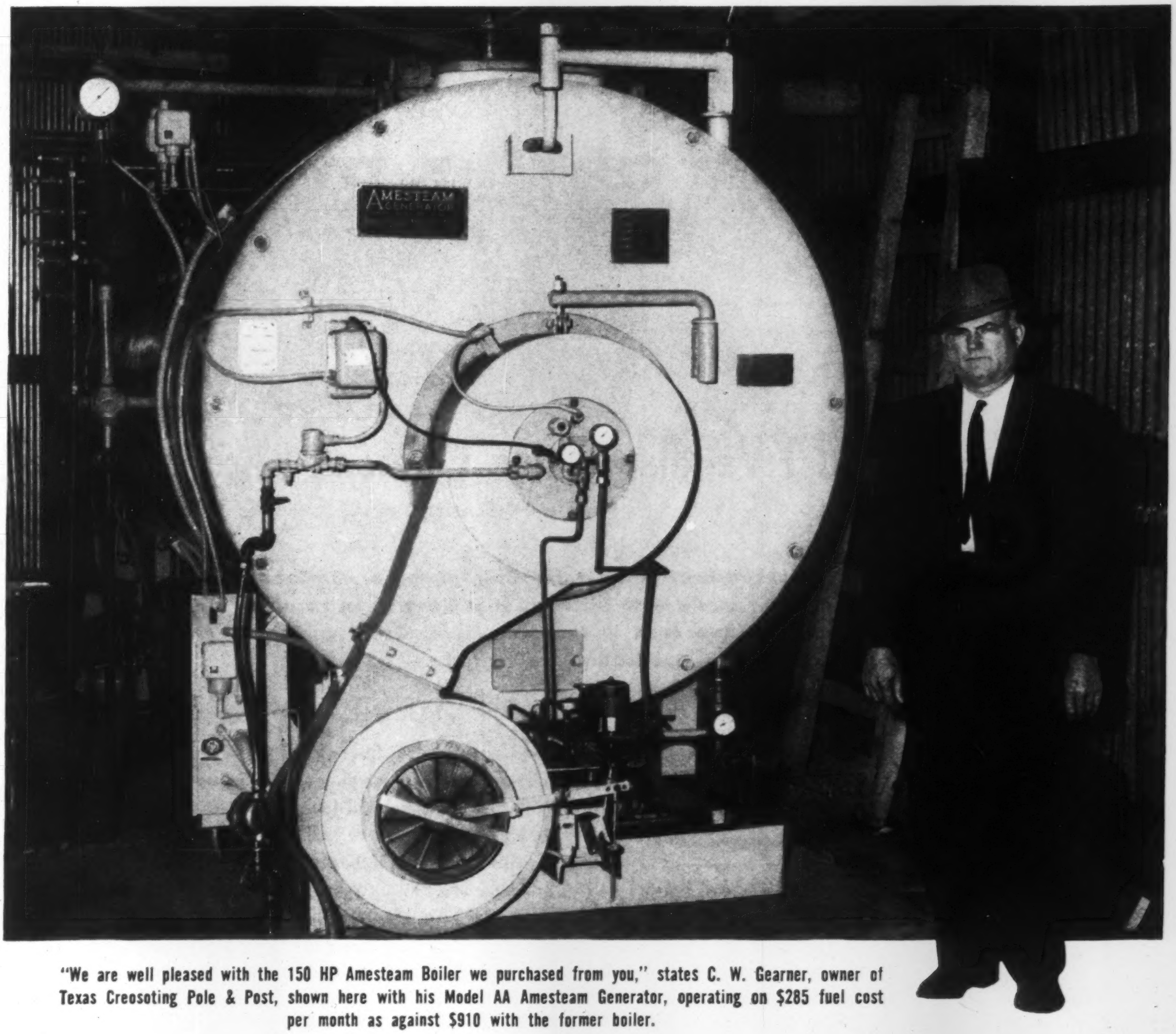
Article Gives Excellent Account of DEW Line Heating System Design

Henry Vaugle's *Waste Heat Recovery System Keeps Arctic Outpost Warm* (February 1959) is a splendid account of the problems involved in providing essential heating and operating environment for buildings exposed to arctic conditions. The article presents in logical fashion the preliminary investigations and their resultant applications. The astonishingly high cost of fuel delivered to the DEW Line outposts spurred the research team to search for every means to utilize every Btu that was available from the ordinary routine operation at the site. The husbanding of this available heat is shown to be effectively accomplished.

In the discussion of the building ventilation, it is not clear how much, if any, of the cold outside air is used. In the living spaces, sufficient ingress and egress is provided so that supplemental outside air is not required. But the area of engine operation is described as almost hermetically sealed. Probably in this case some outside air is needed and, if so, preheating of this supply would be indicated. Also, where a building is so constructed to reduce infiltration to the absolute minimum, the possibility of exhaust gas leakage from the diesel engines could contaminate the breathing air sufficiently so that a special warning device might be installed as a safety measure.

The article is valuable in bringing to the attention of the public the intimate detail of one of the far flung enterprises required to protect ourselves in the cold war.

Lester S. Ries
Consulting Engineer



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question of the month

"How Should I Ventilate Large Cafeteria Kitchen?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers that have been received from readers. One solution appeared in the May issue. Other comments and answers to this question for publication are invited.

> ***"An extensive and complete ventilating system was installed when a modern cafeteria was built three years ago, but the 41 burners in the kitchen, when all are operating, proved to be too much for the system. The temperature in the kitchen is unbearable for the four cooks, bakery personnel, and other occupants. What is the best approach in revising an existing ventilating system in a cafeteria kitchen so that it will perform satisfactorily? I would like to use refrigerated spot cooling to help solve this problem, but it would take many tons of refrigeration capacity to remove the burner load alone. There must be some more practical method than this. I would appreciate seeing how other HPAC readers have attacked similar problems." — T.R.B.***

You Can't Keep on Exhausting Air Without Providing Adequate Makeup

WHILE WE sympathize with T.R.B.'s problem, having seen it happen to a good many other people, we do not believe that refrigeration is the answer. It should be possible to redesign the existing ventilating system to do the job.

Simply stated, two things are essential in a ventilating system: exhaust and supply. While this sounds self-evident, it is surprising how many otherwise intelligent people seem to feel that one can exhaust any amount of air with no regard for makeup.

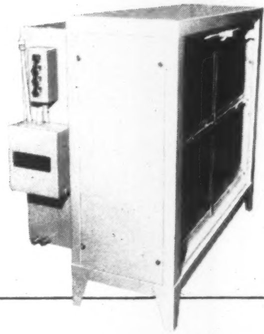
We should examine the existing system for the following elements:

1) Exhaust air quantity. It is assumed that the cooking units are hooded, probably with one large hood with grease filters, etc. There is a great deal of literature on the design of hoods and recommendations for kitchen hood face velocities varying from 70 to 150 fpm. We have achieved good results with velocities of about 100 fpm. This is assuming that the hood covers the entire work area, plus 6 to 12 in. on each side, and is installed not over 7 ft above the floor. Ovens, steam tables, and warmers should also be hooded, though somewhat lower face velocities can be used over steam tables.

We are really concerned with obtaining enough air movement over the stoves to remove the convected heat and fumes and create a flow of cooler air through the working area. If desired, the average face velocity through an area from the stove top to the underside of the hood can be used as a design basis. This velocity should be about 80 to 100 fpm.

In selecting the fan, be sure to allow for static pressure loss through the system, including a sizeable amount for grease filters which are usually not kept clean. We assume $\frac{3}{8}$ in. loss through grease filters.

2) Supply air. This *must* equal exhaust. A simple truism, but, as noted above, it is so often ignored. If the cafeteria air conditioning system has provision for supplying enough outdoor air, this makes a superior source, since we ventilate the cafeteria and provide a source of filtered cool air which helps keep the kitchen people happy. An excellent way of delivering this air from cafeteria to kitchen is through the ceiling space (if such an open plenum is available), with openings in the kitchen ceiling all around the hood. This has worked very well for us.



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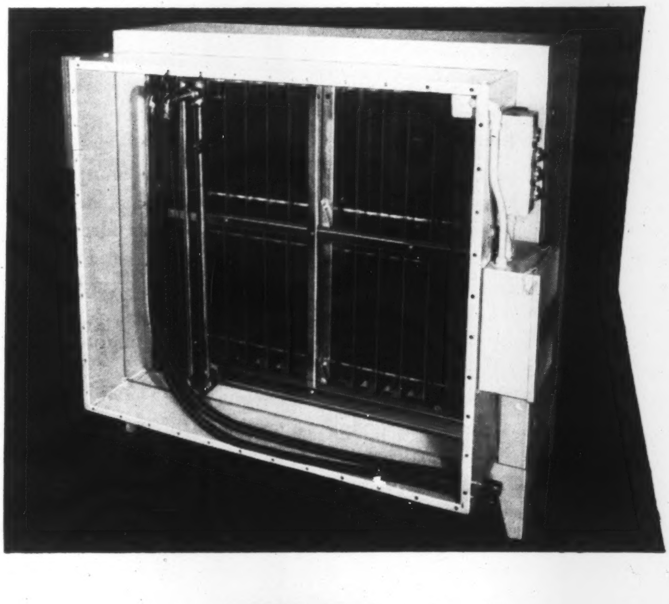

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question of the month

Continued

Another method of supply is directly from outdoors through a large fan coil unit with provision for filtering and tempering the supply air. This is, of course, more expensive than the first method noted, but is very satisfactory.

A third way is to open the windows and let the dirty, cold (or hot) air come in as it will. We deplore this; and so do most health authorities.

If it can be shown that T.R.B.'s system is adequate, both as to supply and exhaust, and working conditions are still unsatisfactory, we would recommend spot cooling by means of refrigerated panels. This has the double virtue of being less expensive than trying to air condition the kitchen, and of not setting up undesirable air movement around the edge of the hood. Care must be taken in panel design to avoid surface condensation.

We are of the opinion that if the ventilating system is made adequate, no additional cooling will be necessary.

ROGER W. HAINES
Chief Engineer
Bridgers & Paxton
Consulting Engineers

Engineer Cannot Compromise with Economy, Space, Architecture

T.R.B. POSES an interesting question. My association with installations of this type leads me to suggest that too often problems such as his result from inadequate or unavailable data regarding the kitchen equipment. In dealing with this problem, the design engineer cannot compromise with economy, space, or superficial architectural considerations.

Lacking more detailed information regarding this particular installation, I have listed the following suggestions in the hope that one or more of them may prove to be of some help.

1) Apparently the system suffers from the lack of adequate exhaust air volume. If space does not permit a supplementary duct system, roof or wall exhausters connected to hoods in the trouble area may help.

2) Hoods over heavy cooking equipment should conform to the following general specifications:

a) Hoods should overlap at least 6 in. beyond edges of equipment.

b) Bottoms of hoods should be a maximum of 6 ft, 6 in. above the floor, or approximately 3 ft above the cooking surface.

c) If hoods contain grease filters, supplement the filter area. (Velocity through grease filters is not to exceed 350 fpm.)

d) Exhaust a minimum of 100 cfm per sq ft of hood area.

3) If fan motor size permits, speed up the fan. Install a larger fan motor if necessary.

4) Divert available exhaust volume to trouble spots by adding new ducts or enlarging present ducts.

5) Efficiency of conventional hoods can be greatly improved by adding a baffle inside, leaving a 2 in. or 3 in. slot around the perimeter of the hood.

Exhausting large quantities of kitchen air requires a source of supply or makeup air of equal volume. The volume of supply should be slightly less than the exhaust to keep kitchen odors from entering the dining area. Properly designed and distributed supply air serves to provide a certain amount of cooling effect even though uncooled outside air is used. Distribution of air should be concentrated in areas of employee activity. If conditions do not permit duct distribution, roof or wall fans may prove satisfactory. If the problem is one that exists in winter, the supply air should be heated to prevent the occurrence of objectionable drafts.

Where air conditioned premises surround the kitchen area and adequate outdoor air is available or can be added to the cooling system, relief or spill air can be diverted from the conditioned space and supplied to the kitchen. This can be done with dampered relief grilles or fans. The use of conditioned air is the most effective. But it is costly if refrigeration must be added to accomplish the desired results.

PATRICK J. BARBIERI
Supervisory Engineer
Armo Cooling & Ventilating Co., Inc.

Spot Cooling Affords Heat Relief To Personnel Working in Hot Areas

THE DESIRE to use spot cooling is not at all unusual, but an understanding of the function of spot cooling is necessary. This type of cooling is not intended to remove (in this case) the burner load, but merely to provide a measure of relief to personnel working in the vicinity of heat release.

From the information given, several assumptions must be made:

1) Hood design may be inadequate.

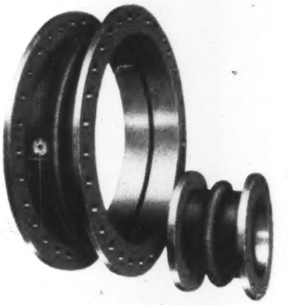
2) Exhaust air quantity may be insufficient.

3) Makeup air may not be supplied to the space in sufficient quantities.

Considering the above, I would recommend the following:

1) Employ a consulting engineer in your area to check the hood design and the face velocity across the hood face area (100 to 125 fpm is recommended) and to determine the sufficiency of makeup air.

2) It would be desirable to provide a fan to supply



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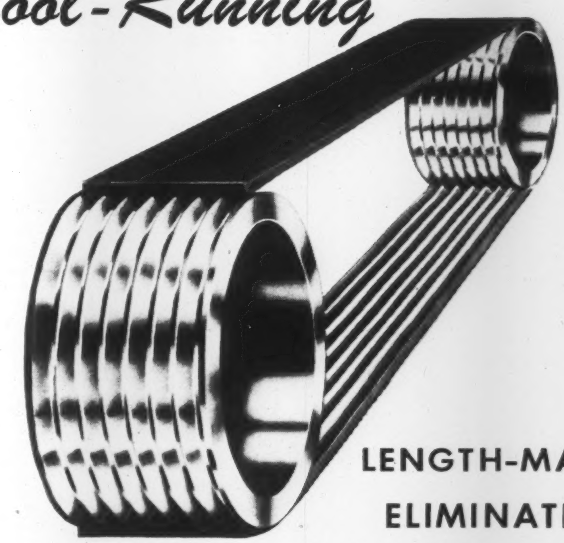

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question of the month

Continued

sufficient air to the space to meet the requirements of exhaust and combustion air, plus a very slight surplus to keep the space under a small positive pressure.

3) With this arrangement, a small amount of refrigeration can be used to cool the supply air if desired. This air can then be directed toward the operating personnel to achieve spot cooling.

William M. Bunting
Associate
Strickland & Associates
Consulting Engineers

Check to Be Sure Supply, Exhaust Air Quantities Meet Design Specs

T.R.B.'s PROBLEM of removing excess heat from cafeterias and kitchens is one which is familiar to all of us who have anything to do with design and operation of ventilating and exhaust systems for these building areas. There are times when the problems are so acute that we wish we were able to install mechanical cooling, but this is not always possible. As an alternate, however, we would suggest first that a thorough check be made of the actual ventilation supply and exhaust air quantities to insure that they meet the designer's specifications. Make certain that filters are checked and cleaned frequently; this is extremely important in order to maintain full ventilation and exhaust requirements and is a point which is often easily overlooked by maintenance personnel.

It would seem desirable to insure that the air supply to the dining area is greater than the total exhaust from the kitchen area. In this way the pressure would be tending to force air from the dining area to the kitchen, thus keeping the heat, steam, and odors from entering the dining area.

In addition to providing ventilation air to the kitchen, we believe that the next step would be to make certain that each heat-liberating work area is adequately, and preferably separately, vented with properly designed hoods or uptakes — even to the extent of installing separate fan units for each of these critical areas.

Range hoods should be designed for at least 150 cfm of exhaust air per sq ft of hood area. We have found that it is helpful to increase the velocity at the perimeter of the hood by installing a baffle covering the intake area except for about 3 in. of width around the perimeter of the hood. It is best to maintain a fairly high capture velocity of air of at least 400 fpm at the perimeter of the hood.

Particularly in large kitchens, it is desirable to install separate exhaust fans for range hoods and for dishwashing rooms. For the dishwashing area, provide general exhaust for the room with additional pickup at the inlet and outlet ends of the dishwasher. We have found that 400 fpm velocity at the dishwashing inlet works fairly well in capturing the steam attempting to leave the unit. Ventilating the kitchen area requires close balancing between the supply and exhaust air, with possibly an excess of ventilation air to maintain as near a positive pressure at the exhaust inlets as possible. It would be desirable to maintain a total air movement in the kitchen of at least one air change every 2 to 3 minutes. Except for extremely warm and humid days and with the system supplying 100 percent of outside air, this amount of air circulation should do a reasonably good job of cooling the kitchen.

Everett M. Bartels
Supervisor of Mechanical Equipment
Des Moines Independent Community School District

READER ASKS —

"What Is Life Expectancy of HPAC Equipment?"

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"In view of these different recommendations, we would like to see some reliable and up-to-date information on this subject."—H.G.C.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

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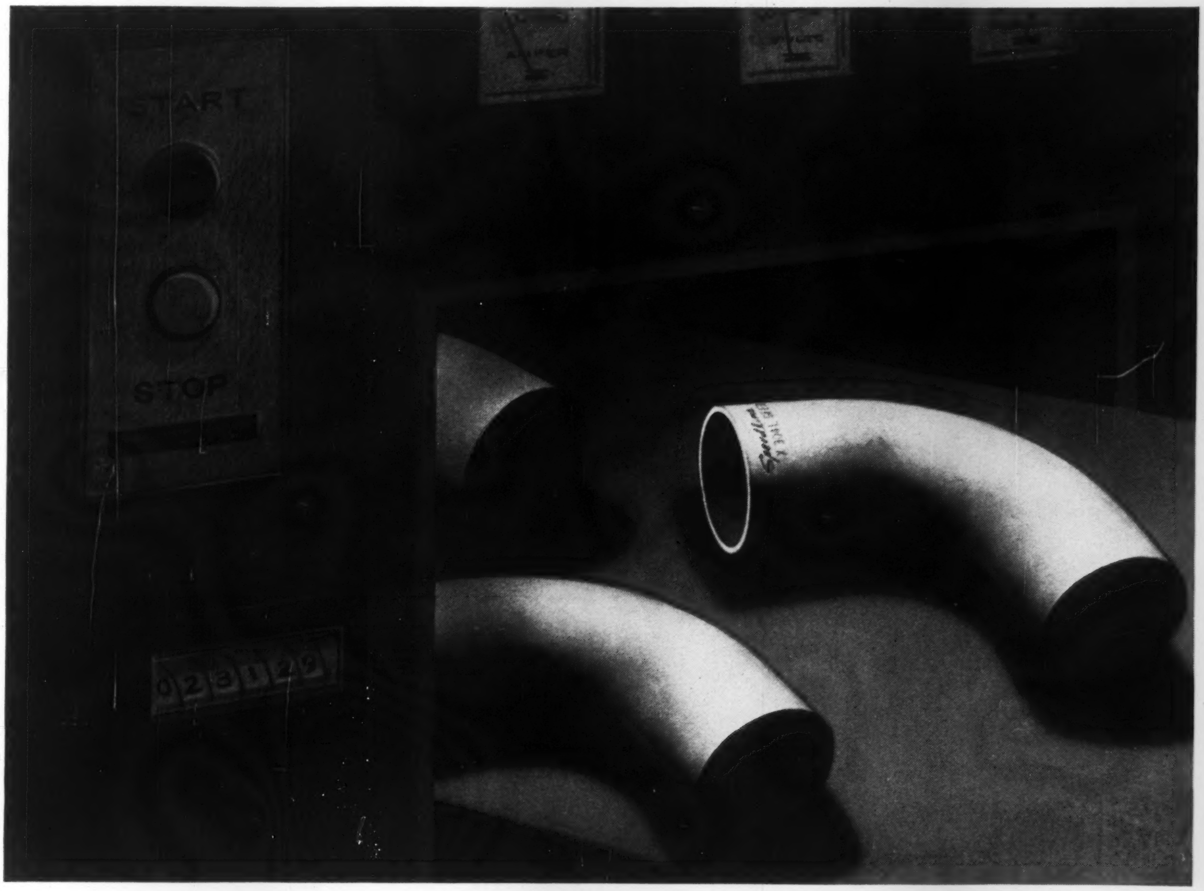

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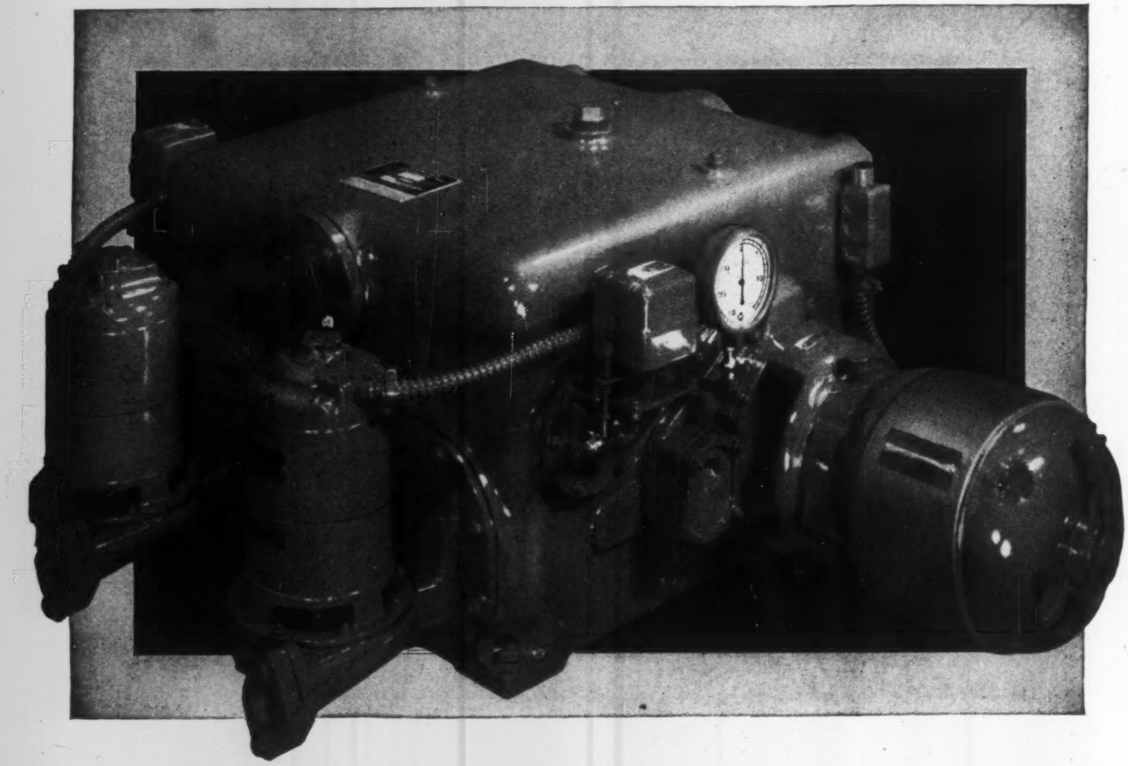
THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



It's the Nash CSM

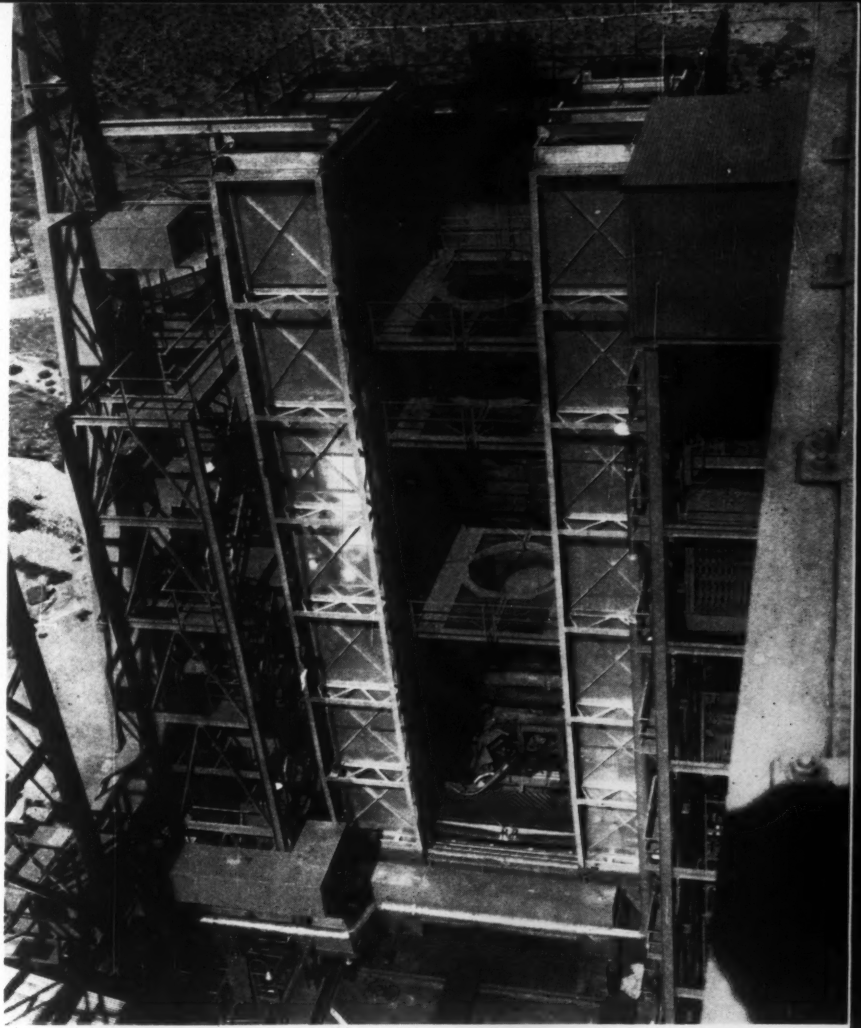
Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- ✓ **Increased air capacity induces rapid system response without wasteful overheating.**
- ✓ **Separate air and water pumps individually selected to meet actual job requirements.**
- ✓ **Control system that operates individual pumps only when needed.**
- ✓ **Flexibility permitting addition of radiation without changing basic pump installation.**
- ✓ **Low, low, return line connection.**

NASH ENGINEERING COMPANY
437 WILSON, SO. NORWALK, CONN.

ARCTIC GALE, tropical rainstorm, or any extreme weather conditions that can be anticipated anywhere on earth are simulated in this environmental chamber to test Thor IRBM. Shown is front view of chamber with doors open. Personnel decks cantilever upward to admit missile



Weather-Test Thor IRBM In Environmental Chamber

By HERBERT H. CHRISTMAN
Designer
Thermo-Conditioning Group
Missiles Div.
Douglas Aircraft Co.

At Edwards Rocket Base, a two and one-half hour drive from Los Angeles, stands the largest environmental test chamber of its type in the world. Tall as a seven-story building, this chamber stands on the crest of a hill, like an acropolis, dominating the Mojave Desert below. From this structure, buffetted daily by sonic booms from nearby Edwards Air Force Base, men can view the fledgling X-15 rocket ship in its checkout flights.

This mammoth icebox/Turkish bath is also pushing back the space frontier. Within, is tested the rocket which is presently America's prime line of missile defense — the Thor intermediate range ballistic missile. This versatile craft is also a booster for a repertory of satellites and space probes, including the Pioneer V which was launched toward Venus' orbit in March.

The missile is held securely within the chamber and captively fired under conditions simulating an arctic gale or tropical rainstorm.

• Simulating weather conditions ranging from an arctic gale to a rainstorm in the tropics, the world's largest environmental test chamber for rockets puts the Thor IRBM through actual launching conditions met anywhere in the world without the missile ever leaving the ground. In providing valuable data on the effects of extreme environments on the Thor, the chamber provides an inside temperature controllable between −35 and 165 F, regardless of the outside temperature. How the system operates, steps taken to combat operating problems, personnel considerations, and other unique aspects of this complex installation are described in this article.

Mr. Christman, who shares the design responsibility for the Thor ground support air conditioning, is a designer in the thermo-conditioning group of the missiles division of Douglas Aircraft Co. Graduated with a BS in mechanical engineering from Rensselaer Polytechnic Institute in 1951, he has held several positions in the air conditioning field, including design and test responsibility for the high velocity duct systems in the Boeing 707 jet transport. Mr. Christman authored the HPAC Engineering Data File, "Environmental Control: Key to Success of the Manned Earth Satellite," in the October 1959 issue.

To accommodate the 65 ft long, 8 ft diameter missile, the chamber was built 20 × 24 × 75 ft high. With associated ducting, it contains a volume of approximately 40,000 cu ft. The chamber walls are constructed of aluminum covered, paper honeycomb panels, sealed at each corner with cork. Inside are five levels for access to the liquid fueled motors (main stage and verniers), the inertial guidance compartment, and all instrumentation and airborne electronic equipment. Entry is through freezer type doors with vestibules or air locks at each level.

To resist the intense radiant heat from an engine consuming fuel and liquid oxygen at more than 4000 gpm, panels of aluminum and cement-asbestos sandwich have been added to the lower part of the chamber. Before firing, the bottom floor is rolled away, exposing a 10,000 gpm water cooled deflection plate below the nozzle. The bottom of the chamber is sprayed with water to prevent damage from the exhaust which, in creating 75 tons of lift, generates a core temperature of 6000 F.

Two 9 × 69 ft electrically operated doors at the front of the chamber permit installation and removal of the missile, using a gantry crane which covers the missile and apron.

Inside temperature is controllable between −35 and +165 F. Besides thermal conditioning, rain simulation nozzles on three levels permit any selection of rainfall from cloudburst to a drifting mist.

Among the many test objectives the chamber has fulfilled are:

1) Determination of heat transfer rates between the controlled ambient and the inside of the inertial guidance components and the engine section.

2) Determination of temperature distribution within the above areas.

3) Demonstration of the capability of existing ground support air conditioning.

4) Determination of missile temperature transients when air conditioning is interrupted.

5) Demonstration of operating capability of airborne hydraulic, mechanical, and electronic equipment.

6) Evaluation of operational problems and hazards of LOX (liquid oxygen) and fuel loading in extreme environments.

How Cooling Is Supplied

As mentioned earlier, design requirements for the chamber are −35 to +165 F. This span must be provided throughout an outside temperature range of 15 to 105 F. Refrigeration is accomplished by evaporating liquid nitrogen in a coil. Liquid nitrogen is supplied under its own pressure from two cryotanks with capacities of 1000 gal and 2000 gal, respectively. One tank is tapped while the other is being filled.

Economics favor this method, since the nitrogen is furnished by the base's own cryogenic plant as a byproduct of LOX manufacture. After evaporation at about 40 psig, the cold nitrogen gas is discharged from the coil to atmosphere.

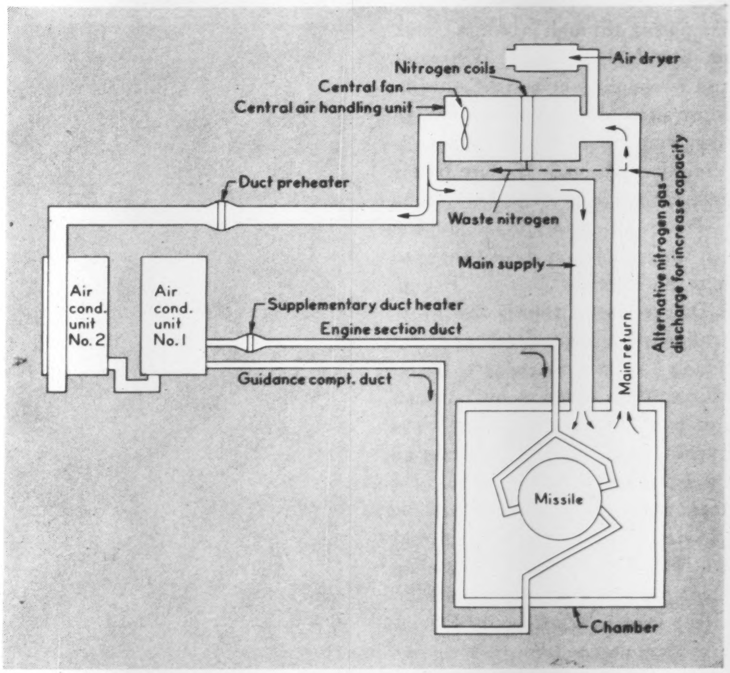
When the desired chamber temperature is −35 F, nitrogen gas is diverted into the return air duct of the coil. By so superheating this gas from −300 F to chamber temperature, its capacity is increased about 75 percent—a net increase of 33 tons of refrigeration at maximum nitrogen flow of 1000 gph. The nitrogen is discharged into the return air duct because its coldness and dryness lengthens the defrost cycle time, a critical factor especially at startup. Diverting this gas into the chamber gradually inerts the interior, necessitating a separate source of breathing air for personnel. This is discussed later.

The capacity of the coil at maximum nitrogen consumption is 50 tons when nitrogen discharge gas is saturated. As mentioned, superheating the gas to chamber temperature yields an additional

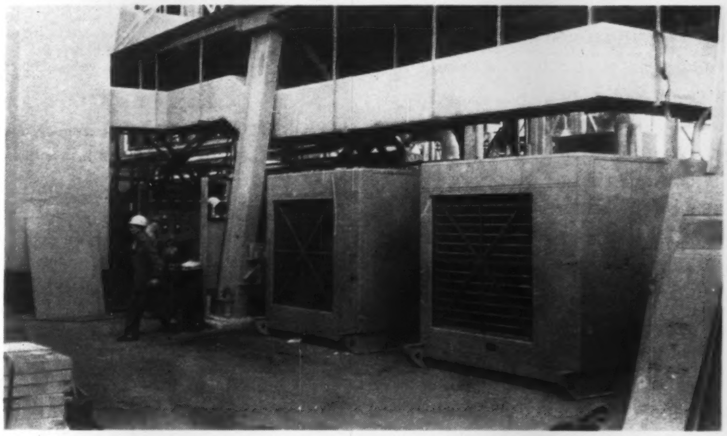
33 tons. The relatively low tonnage due to phase change results from the small latent heat of vaporization for liquid nitrogen of 85.8 Btu per lb. Each coil is about 20 sq ft in face area. Tubes are seven fins per in., five rows deep. Face velocity is approximately 1000 fpm.

Snow filters originally installed downstream of the coil were removed when experience showed no frost buildup on the fan due to carryover. Farther downstream however, it is necessary to intermittently energize the electric duct heaters. This removes gradual accumulation of fluff frost. The central fan is run for 10 minutes after the refrigeration is shut down to prevent condensation of liquid oxygen on the coils, since liquid oxygen's liquefaction point is 23 F higher than that of liquid nitrogen.

Heating of the chamber is accomplished by automatic control of duct heaters on the four supply air levels.



TEMPERATURES as low as −35 F are achieved in chamber through use of waste nitrogen in combination with prechilled air delivered by air conditioning units Nos. 1 and 2 above. Shown below are units in place



Circulate 40,000 Cfm

The prime air mover is a single axivane propeller fan powered by a 40 hp motor. Approximately 40,000 nominal cfm of air is circulated at standard conditions.

Originally, the fan blade pitch was adjustable semi-automatically to compensate for changing air density during pulldown. Low temperature operating difficulty prompted a change to a manually adjustable pitch fan, permanently set for maximum air flow. Discharge grilles are single deflection, with 1 in. vane spacing to discourage frost buildup by induced air.

Combat Air Stratification

Minimizing stratification is a prime consideration in this tall and comparatively narrow enclosure. This is particularly true in a cold chamber where hot air is introduced as part of the load (approximately 2000 cfm of heated air is blown into the missile). This air exfiltrates into the chamber.

With an average temperature difference during a cold test of 120 F, a chimney of warm air is created which must be offset by rapid air motion and selective air distribution. Chamber air velocity is kept turbulent at from 800 to 1500 fpm. Multi-level supply air dampers are semi-automatically controlled in response to a temperature readout at each level. Reverse stratification occurs in a hot chamber when LOX is pumped aboard the missile.

Offset Infiltration, Frost

At this isolated and elevated location in the Mojave Desert, 40 mph winds with 60 mph gusts are not unusual. Therefore, up to 650 cfm of outside air is furnished to help neutralize infiltration. To reduce the outside air latent load at low chamber temperatures, this air passes through a commercial, rotating bed, silica gel desiccator and is supplied at about 2 grains. Infiltration due to personnel going in and out of the chamber is minimized through the use of air lock entrances.

There is no need for outside air when nitrogen gas is injected into the chamber.

Due to the extremely low evaporation temperature of approximately —300 F, defrost is required. This is done by alternating two adjacent coils and their bypass dampers. Defrost frequency is judged by inspection of a manometer across the coil and viewing the coil face itself through an inspection window. When the air side is pulled down and the latent load is light, both coils operate simultaneously.

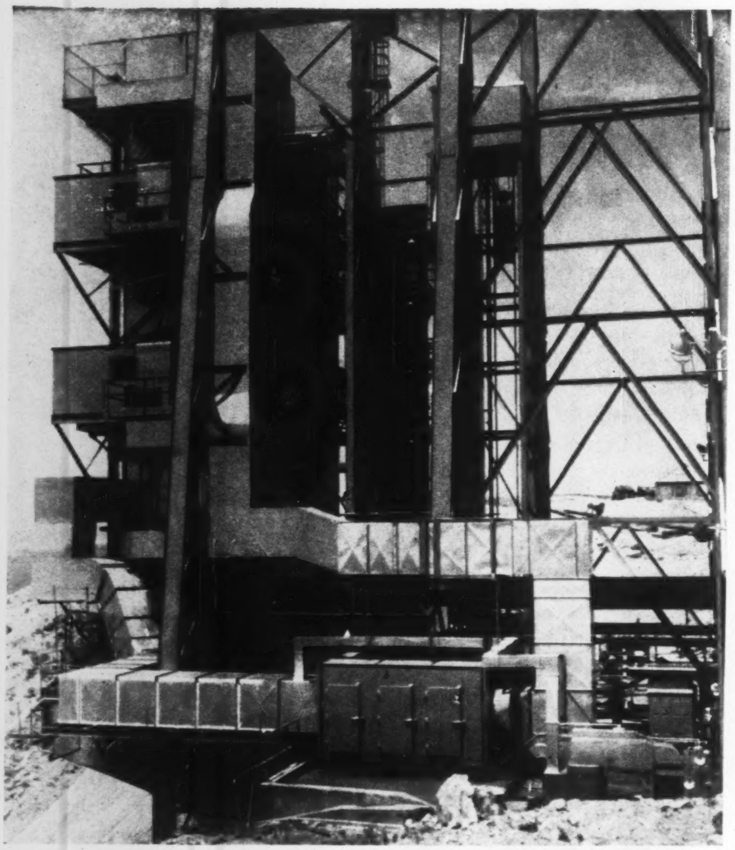
In actual operation, there is no crystalline ice deposit but a hard white frost. Defrost is generally begun when 20 percent of the coil face is frosted and concluded when defrost air leaving the coil rises to 180 F.

Defrost bypass dampers are fitted with extruded silicone seals at mating edges. These are adjusted for tightness with a 0.005 in. thickness gage, since even the slightest leakage of — 35 F air would extend defrost time immoderately.

Each coil has its own defrost system. This consists of a 5 hp blower drawing 2000 scfm of outside air through two 54 kw heaters, blowing it at 200 F through the evaporator coil and thence to the atmosphere. Defrosting requires approximately one-half hour. Obviously, the coil is never to be completely frosted over or defrost would be impossible.

Control Missile Temperatures

Approximately 2000 cfm of conditioned air is supplied to the missile to maintain engine and guidance compartment temperatures within prescribed limits.



WEST SIDE of environmental chamber shown above. Duct on left is return. Extending to top of chamber is supply. Air handling unit is in foreground

Conditioning is done with two 60 hp, skid mounted, air cooled units. The units are self-contained, including an air compressor for the pneumatic controls. Cycling is done with leaving air thermostats located in the missile inlet ducts.

In order to minimize the outside air latent load, all return air to these units is taken from the central apparatus supply duct. Missile air is never delivered at dewpoint temperatures higher than 30 F. Two alternately defrosted 30 F coils are downstream of a 40 F precooling coil. Defrost is controlled by a preset timer which actuates bypass dampers.

The control console consists of the following instruments and readouts:

1) On-off and maximum supply temperature control for seven 3-stage duct heaters at the four supply levels

2) Supply temperature recorders

3) Fan supply and differential pressure controls

4) Supply damper control and position indicators

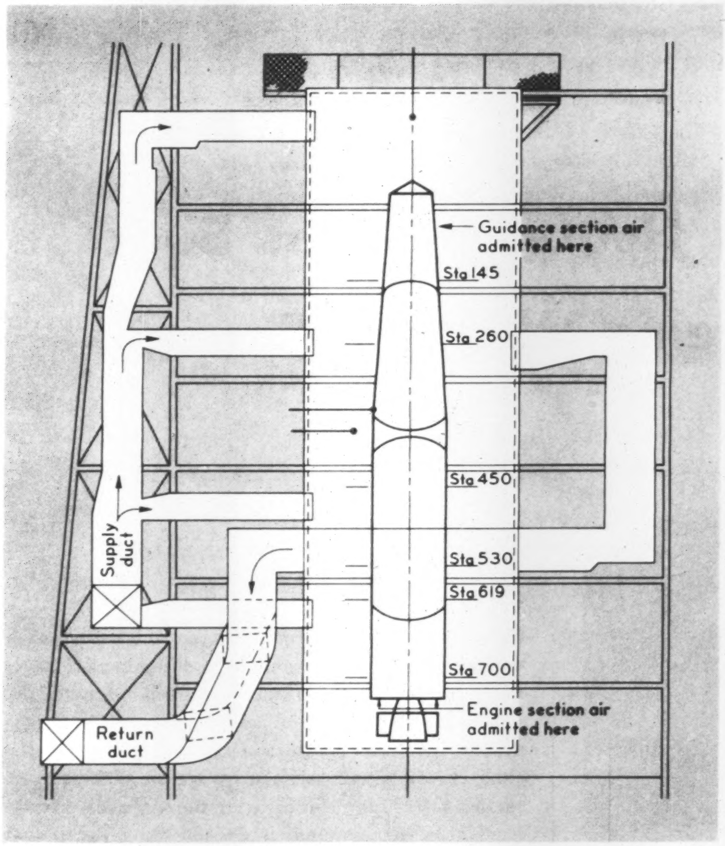
5) Return damper positioners

6) On-off control for fan, liquid nitrogen supply, and rain simulation nozzles

7) Transfer switches to permit control from the blockhouse during countdown

8) A 24-point temperature pickup for readouts on the air side.

All dampers and valve actuators on the chamber are pneumatic, utilizing gaseous nitrogen bled from the same bottles used to purge the engine area before engine ignition. Controls are in-


Guidance section air admitted here
Sta 145
Sta 260
Sta 450
Sta 530
Sta 619
Sta 700
Engine section air admitted here
Supply duct
Return duct

ELEVATION VIEW of chamber shows temperature monitoring system. Stations indicate thermocouple locations. Temperature pickups are 1½ ft from missile skin

terlocked for automatic operation.

Duration of pulldown and stabilization varies from 6 to 12 hours, depending on desired chamber temperature and outside conditions. Average straight line pulldown rate is about 7 F per hr. Because of the proximity of RP-1 rocket fuel and LOX, all switchgear is explosionproof.

Personnel Wear Special Suits

Due to the need for personnel access to the missile for unspecified lengths of time between −35 and 160 F, a special garment must be worn. This consists of an Air Force MA-2 type ventilated garment—a double-walled plastic coverall, umbilically connected by ¾ in. flexible hose to a wall-mounted quick-disconnect fitting.

The garment is supplied with 45 F to 125 F air, depending on the chamber temperature. About 13 cfm of air is furnished, controllable by the wearer to his comfort. The garment inner layer is fully imperforated for even distribution. A pressure regulation valve worn on the belt reduces supply pressure from 100 psi to 7 in. wg.

At chamber temperatures above 115 F, conventional coveralls only are worn over the garment. For prolonged entry at sub-zero temperatures, full Air Force cold weather gear is worn over the suit. This consists of a B-9 helmet, a hooded parka, trousers, light and heavy socks, flying boots, and mittens. The ultimate criterion of dress is worker comfort and efficiency. For a quick "in-and-out" look, a plain parka is satisfactory.

The diversion of coil discharge nitrogen into the chamber gradually inerts the atmosphere, requiring that external breathing air be supplied. Such air supply also precludes nasal frostbite or discomfort should respiration quicken due to physical exertion.

Breathing air is furnished in much the same way as ventilated suit air. A flexible hose connects the wearer's demand regulator to quick-disconnects at each level. The demand regulator, which furnishes air only during inhalation, bleeds into a wide vision face mask. A reciprocating compressor furnishes 37 cfm of breathing air at 125 psig to a maximum of eight regulators. A water cooled aftercooler reduces supply air temperature to a breathable level. An impingement type water separator guards against the danger of accumulated carryover freezing inside the chamber piping. A filter removes entrained oil.

In the interest of safety, workers in an inerted chamber work in pairs. By using this system, the danger of accidental hypoxia is minimized.

Cool, Heat Rocket Fuels

In order to simulate temperature extremes more realistically, the fuel is cooled or heated prior to loading aboard the missile. The RP-1 rocket fuel is controllable from −70 to 180 F. Cooling is done by spraying a maximum of 5 gpm of liquid nitrogen over a coil through which 60 gpm of fuel is recirculated. The nitrogen is stored in a 1300 gal cryotainer. Heating is done with five 27 kw immersion heaters within a 7500 gal tank.

Conditioned fuel is then pumped into the missile at 500 gpm. In this way fuel valves, meters, pumps, etc., are tested under ideal simulation. Moreover, an otherwise incongruous heat source or sink to temper ambients inside the missile is eliminated. ∓

IN ALASKA

Return Air Heater Systems Buck Quick, Extreme Weather Changes

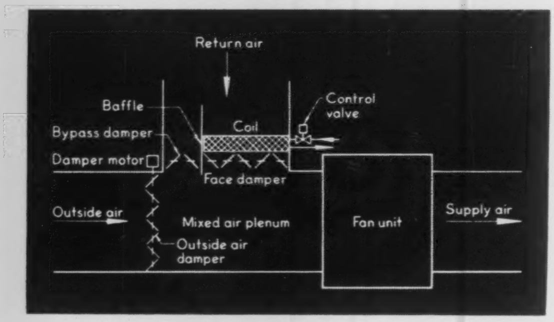
By JOHN D. AUNGST
Associate and Senior Engineer
Ralph R. Stefano
Consulting Engineers

HEATING and ventilating in Alaska's interior suffer the same malady they did in the continental states some years ago — from lack of published design data. To further complicate the matter, not only are the extremes in these northern climes very severe, but changes are often unbelievably rapid. Temperature ranges of −50 to +50 F within the space of 24 hours have been encountered, and controlling the indoor temperature during such wide variations has been a challenge.

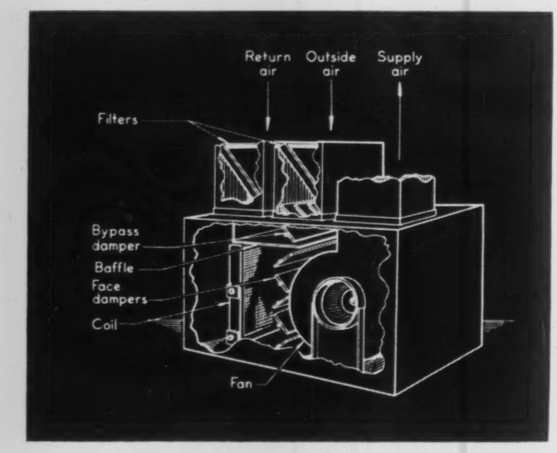
With this kind of experience as a guide, a return air heater was devised to solve this problem. The first such unit was fabricated on-the-job in 1956 in a military building in the interior of Alaska. Its appearance was crude, but it functioned quite adequately. Since this prototype has been placed in operation, many similar heaters have been installed. Refinements and modifications were devised as deemed necessary by climatic peculiarities and known occupancy requirements.

The primary objective of the return air heater is to supply a maximum quantity of outside air to the conditioned space, regardless of outdoor temperature, without subjecting the heating coil to possible freezing. By superheating the return air, it is possible to mix the return and outside air to acquire a satisfactory temperature for distribution.

Fig. 1 illustrates the arrangement of the components provided in the field-fabricated assembly, including dampers, coil, fan unit, filters, and controls. Another arrangement, indicated in Fig. 2, incorporates these same features. A recently completed installation utilizing such a unit has been operating in −50 F weather with favorable results. Space comfort is now provided through these wide temperature fluc-



1 FIELD FABRICATED assembly for return air heating system includes dampers, heating coil, fan unit, filters, controls. Various modifications are possible to meet particular climatic conditions, occupancy requirements



2 PACKAGED UNIT incorporates same components as field fabricated assembly. Outside air and return air bypass dampers are synchronized and oppose coil face damper. Arrangement affords easy control of mixed air temperature

● Alaska's frequent daily outdoor temperature variations of 100 F being too rugged for conventional heating methods, a return air heating system has been devised to provide indoor comfort in spite of extremely fast temperature drops and increases. The system, designed on the principle of mixing superheated return air with the maximum amount of outdoor air that can be admitted and still maintain the desired indoor temperature, has been applied in numerous military and commercial structures throughout our 49th State. Operation has been very satisfactory, operating costs are in line with conventional systems, and maintenance has been minimum.

Mr. Aungst attended the University of Minnesota and received his BS in mechanical engineering from Oregon State College. A registered professional engineer in Oregon, Washington, and Alaska, he is a member of ASHRAE and NSPE.

tuations which can occur almost without warning.

The components are arranged so that outside air and return air bypass dampers operate in unison, and the coil face damper opposes them. When the outside temperature nears design, the outside air damper approaches its most closed operating position, and the coil takes most of the air flow. Control under this condition is easy to maintain because the coil discharge air temperature is reasonably low and slight movement of the dampers has minimum effect on the mixed air temperature.

When the outside air temperature approaches 70 F, the desired room condition may be more difficult to maintain within close limits, because the high coil discharge air temperature will tend to overheat the mixed air with slight opening of the face damper. However, in virtually all occupancies encountered, the heating cycle at outside temperatures above 50 F is quite uncommon. This fact can be attributed to normal body and equipment heat gains as well as to extremely well insulated structures. In addition, the bypass around the coil acts as a relief passage for the return air, thus minimizing the coil leakage and affording more adequate control.

To aid the control at all conditions, a baffle is located adjacent to the coil extending into the return duct. This baffle prevents bypass air from wiping heat from the coil surface. If allowed to occur, this heat exchange could appreciably disturb the thermal balance of the system.

Describe Typical Installation

Curves "A" of Fig. 3 describe the coil loads and discharge temperatures required for a typical installation. The assumed system operates under the following conditions:

1) At an outside design temperature of −50 F, a minimum of 25 percent outside air is provided.

2) At 70 F outside, 75 percent outside air is supplied.

3) The bypass around the coil is 25 percent of the total return air duct area.

4) Return air temperature is 70 F.

5) Supply air temperature varies linearly from 130 F at −50 F outside to 70 F at 70 F outside.

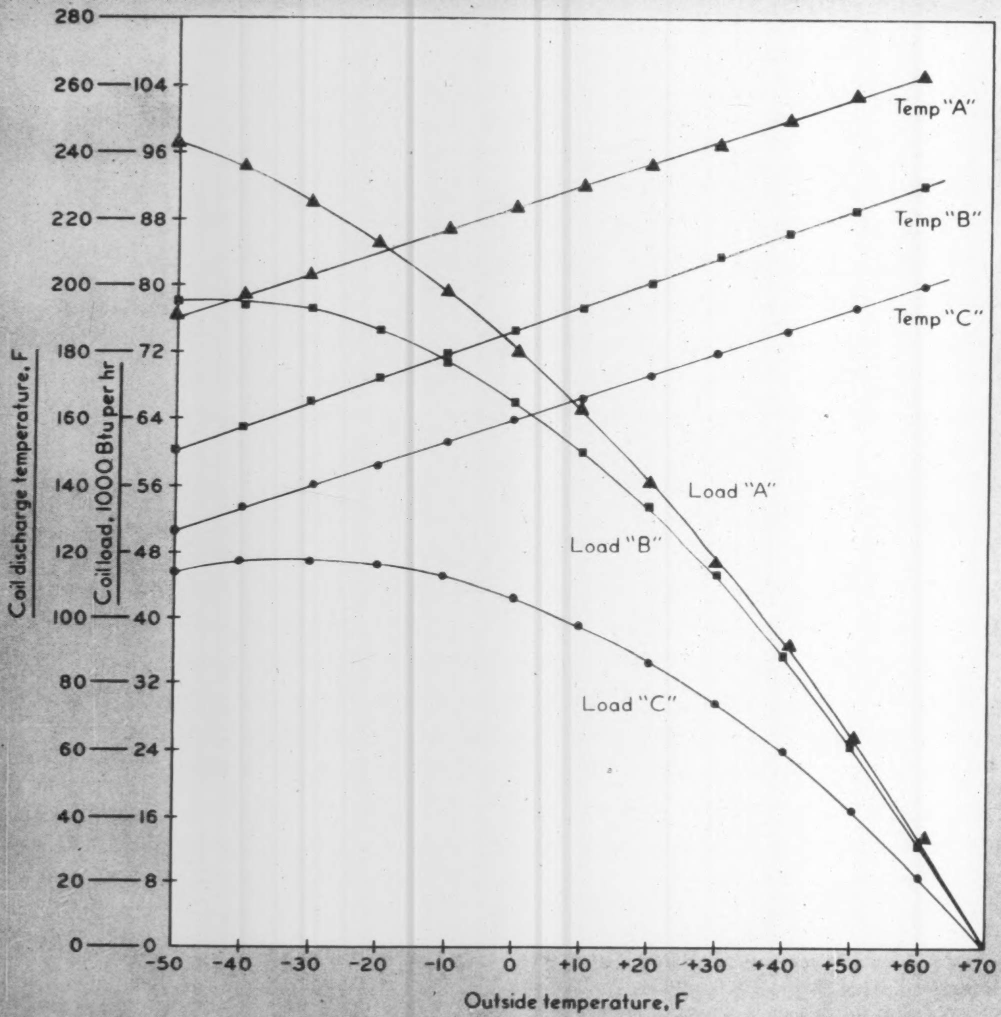
6) Fan delivery is 1000 cfm.

7) Steam at 5 psig is supplied to a coil through a two-position control valve.

As a comparison of differing systems, curves "B" and "C" in Fig. 3 reflect the changes in coil loads and coil discharge air temperatures from the above example. The design for the conditions determined is obviously inadequate, since the required coil discharge air temperature for outside air exceeding −10 F is higher than that available when using 5 psig steam. Therefore, to correct this impossible situation, the design of 25 percent outside air at −50 F is changed to 10 percent outside air. Curves "B" represent the results of the change. The system is now operable under all conditions of outside air up to 40 F.

Automatic positioning of the dampers to allow more return air through the coil — should more heating capacity be necessary — will serve to extend the operating range to 70 F. Should this type of system be desired for ventilation only, it can readily be adapted to fit the need. By changing requirement (5) in the example to supply 82 F instead of 130 F air at −50 F outside, a well-controlled ventilating system is available, as shown in curves "C" in Fig. 3.

Control is accomplished by a thermostat (or the average of several thermostats through an electronic panel) positioning the damper motor. The control valve selected is of the two-position type and is constantly energized when the outside air is 60 F or below. A low limit thermostat in the fan discharge duct keeps air colder than 60 F from being delivered.



3 COIL LOADS, DISCHARGE TEMPERATURES required for a typical installation are plotted on curves "A." Operating conditions are given in text. Curves "B" and "C," comparing different systems, reflect changes in coil loads and coil discharge air temperatures

In the event of an unusual situation where the coil is subjected to freezing air, a nonfreeze control located at the outlet face of the coil shuts down the fan and closes the outside air damper.

System Offers Numerous Features

The return air heater, as applied to numerous military and commercial installations, has proved advantageous in many ways. It provides (1) exceptionally close control under subfreezing conditions, (2) quick recovery with rapid load changes, (3) an inherent nonfreeze feature without the use of ethylene glycol or other antifreeze solutions, (4) a fixed minimum supply of outside air delivered at the desired temperature when it is at design temperature, (5) an effective use of hot water rather than steam as the heating medium through the use of a three-way modulating valve positioned by a potentiometer mounted on damper motor shaft, (6) automatic operation of dampers to handle a cooling cycle at outside temperatures of 50 F and lower, and (7) multiple configurations to provide the same end results.

Three typical installations where this system has been applied with success are in a bowling alley, a television studio, and a commercial building.

System Serves Bowling Alley

The bowling alley is located in the basement beneath a new supermarket. The space has no natural ventilation, except through the entrance itself. The type of occupancy creates a substantial heat gain. For these reasons, a system employing considerable outside air had to be utilized to maintain the proper comfort level. Since the return air heater had proven to be the best means for accomplishing this and still afford heat when required, this method was employed.

Actually, three units were installed; one supplies air to the area of participation, one to the concourse and lounge, and the third to the nursery, lockers, and toilet rooms. Exhaust fans are installed to provide complete circulation when outside air is introduced.

A noticeable aspect of the system is the clearness of the air for the bowlers; all smoke is gently drifted down the alleys to the main exhaust behind the curtain wall at the pin setting equipment. This system has been more than satisfactory, as indicated by the owners. Through the last winter, the temperature was maintained within 1 F of the thermostat setting and the ventilation was completely satisfactory.

Control TV Studio Within 1 F

A television studio can be a most difficult space to condition due to rapidly changing loads. In this case, the studio is located on the fourth floor of a new office building. Two units are installed in a void space above a stairwell with ducts distributing air to the television and radio studios, offices, and transmitter rooms. One return air heater is designed as a heating and ventilating unit for the office spaces; the other handles heating, ventilating, and cooling loads of the studio areas. In actual operation, the controls maintain the desired air temperature of 69 F within 1 F during all load changes. This fact is quite impressive when one realizes the rapidity of recovery when 15 kw of studio lights alone are turned off and on and yet not have any appreciable override or undershoot of space temperature.

Commercial Building Uses No Exhaust Fan

The commercial building considered is a retail dress shop. One return air heater is the sole source of heat for the entire structure, except for a single strip of radiation under a large second floor window. The system differs from the two other examples in that no exhaust fan is used to remove excess air brought into the building by the ventilating unit fan.

A system of relief grilles is connected to an exhaust duct in which a backdraft damper is installed. This provides a positive pressure within the structure, thus creating an exfiltration through the doors, precluding the admission of airborne dirt from the street. The heater supply duct contains an electrostatic filter and a humidifier.

No Provision for Mechanical Cooling

None of the three systems has any provision for cooling by mechanical refrigeration. As mentioned previously, cooling can be adequately provided at outside temperatures of 50 F and lower. The mean high temperature in the Fairbanks area exceeds 70 F for only 60 days out of the year, attaining only 73 F maximum; the mean low for this period is 49 F and less. The average exceeds 50 F from May 23 to August 31, peaking at 60 F. Therefore, it can be reasoned that the small sacrifice of comfort for this short period can be compensated for by the reduced cost of installation in the new State of Alaska.

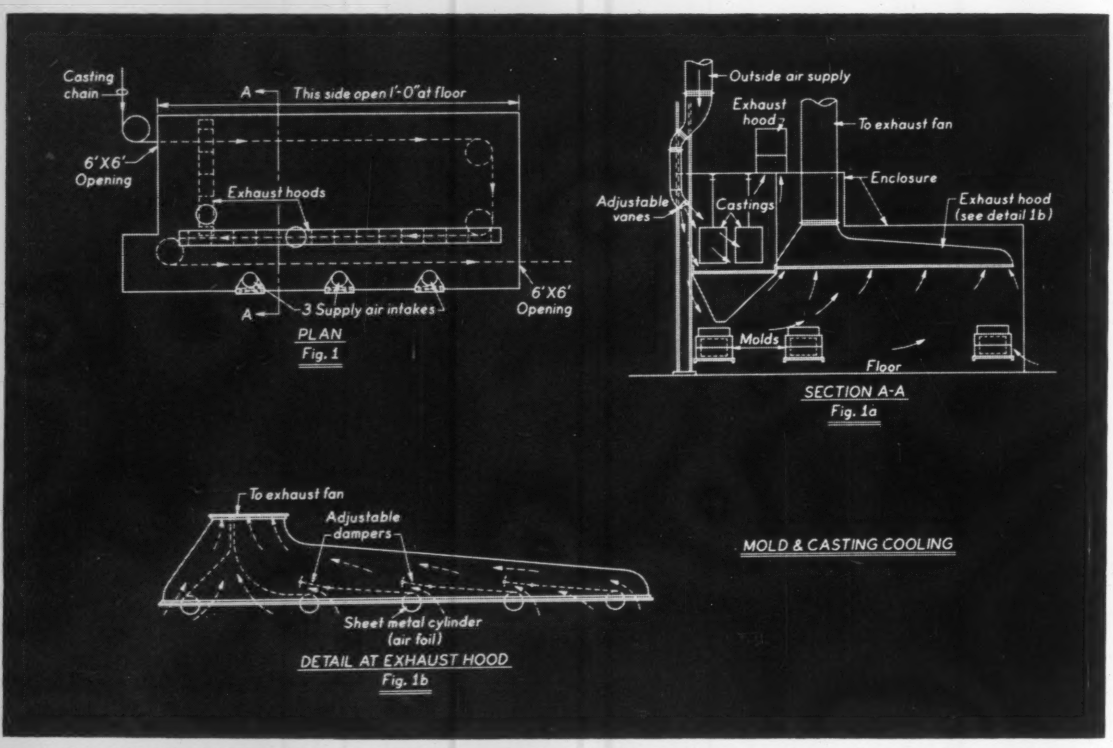
Consider Limitations, Too

Even with the best of equipment, limitations must be realized. The return air heater being no exception, the following factors must be considered for a given application: (1) return air must be available in the system in sufficient quantities to provide proper mixed air temperature without an excessive coil discharge temperature; (2) on a cooling cycle, some air is returned from the conditioned space, thus precluding full outside air during summer operation.

In most of the designs developed, the return air heater has been installed in conjunction with hot water or steam radiation. In these applications of split systems, air is used primarily for ventilation, absorbing a maximum of 20 percent of the heating load. The air system is set to provide the final room temperature during the heating season by varying the amount of outside air necessary. This can be accomplished by sequence control. For summer conditioning, refrigerated cooling is readily adaptable by installing a cooling coil in the return air duct. Humidification with steam or pan humidifiers adapt as easily here as they do to other systems.

The return air heater accomplishes all three functions of heating, ventilating, and cooling. By designing a system for either heating or ventilating, cooling for the space is available as long as the outside temperature is 50 F or below.

In addition to this versatility, the system using this built-up heater has proven economical. Installation costs are reduced essentially by the cost of freeze protection devices otherwise required. Operating costs are virtually the same as for a conventional system which introduces the same amount of outside air. And most important in the arctic area, maintenance is kept at a minimum, since the return air heater has built-in features which preclude the necessity of a watchful eye while absorbing the punishment of temperature adversities. +


Casting chain
A
This side open 1'-0" at floor
6'X6' Opening
Exhaust hoods
A
3 Supply air intakes
6'X6' Opening
PLAN
Fig. 1
Outside air supply
Exhaust hood
To exhaust fan
Enclosure
Adjustable vanes
Castings
Exhaust hood (see detail 1b)
Molds
Floor
SECTION A-A
Fig. 1a
To exhaust fan
Adjustable dampers
Sheet metal cylinder (air foil)
DETAIL AT EXHAUST HOOD
Fig. 1b
MOLD & CASTING COOLING

1 SHEET METAL ENCLOSURE illustrated above is designed for mold and casting cooling installation. Adjustable vanes (Fig. 1a) can be set manually to obtain desired air flow pattern

Supply Makeup Air for Plant Exhaust Without Adding to Heating Costs

• In many manufacturing plants, particularly foundry operations, huge amounts of air must be exhausted to carry off the fumes, dust, gases, etc., that emanate from production processes. The makeup air that must be admitted to balance the exhaust can add considerably to heating costs unless some way can be devised to introduce it without heating it. The author tells how this can be done, citing four systems that have proved very satisfactory in actual operation.

Mr. Kaulfuss has been active in the design, installation, and maintenance of heating, ventilating, and air conditioning systems for more than 30 years, the last 15 of which he has spent as a staff engineer in the plant engineering department of the Peoria, Ill., plant of Caterpillar Tractor Co. A registered professional engineer in Illinois, he is a member of the ASHRAE's research advisory committee on industrial environment.

By H. P. KAULFUSS
Staff Engineer
Caterpillar Tractor Co.

MAKEUP AIR, to compensate for air removed by plant exhaust systems, can be supplied without adding to heating costs. Ten years ago this statement, would have met with skepticism. However, during the past decade much has been done to bring about a closer balance between the air being supplied to a building and that being exhausted.

Since every exhaust system must ultimately be supplied with air from an outside source, why not introduce outside makeup air direct-

Here's how Caterpillar Tractor makes-up with unheated outside air

ly into the exhaust facility without heating it? Obviously, this cannot be done on *all* exhaust systems, but it should be considered on applicable installations — both old and new.

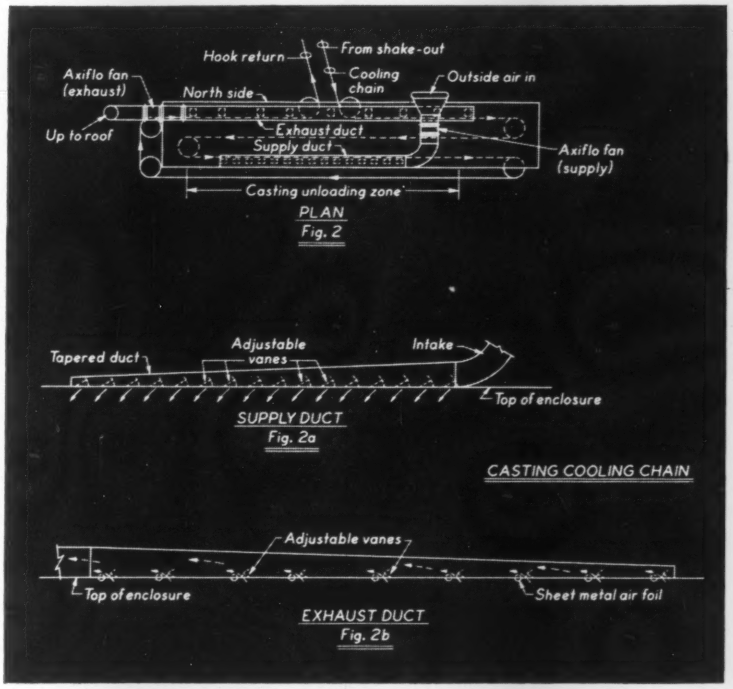
Heating costs are a prime factor to consider in designing makeup air for an air-starved building. Whenever we can introduce this air without heating it, we save this cost and help reduce the negative pressure within the building.

Foundry operations in all big industries must necessarily include the use of tremendous amounts of exhaust air because of the fumes, dust, gases, etc., that must be eliminated from the building. These exhaust volumes are often in the millions of cfm and must be considered very seriously in the design of makeup air systems. Most foundries suffer greatly from a lack of adequate makeup air. This need becomes increasingly aggravated during the heating season when all doors and windows are closed.

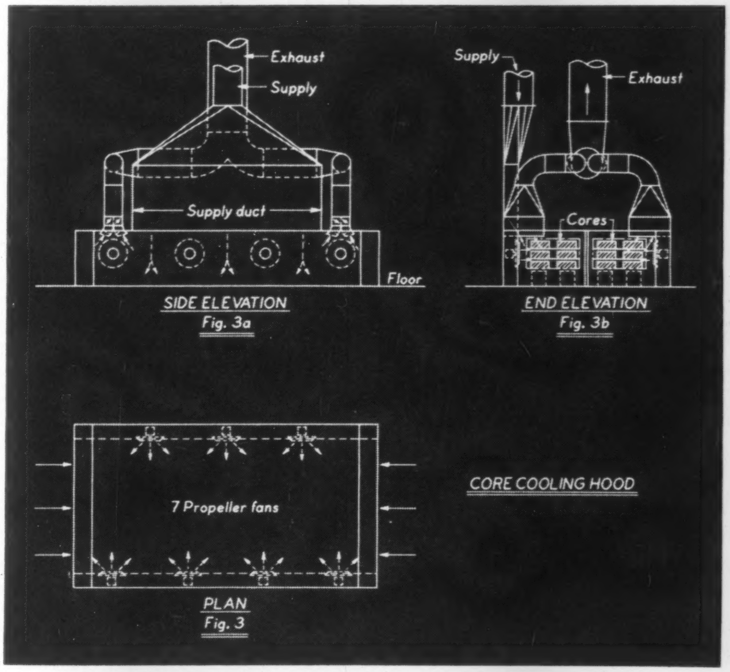
Since makeup air must be provided for the various systems, every crack in the building, every window, every door, every other outside access becomes an air intake. This colder air creates many objectionable drafts and causes numerous complaints from workers. Add to this the many openings necessary for bringing in materials, and the conditions are sometimes intolerable.

The only real answer is to supply makeup air by one means or another to balance the air being exhausted. Preferably, provide air quantities slightly in excess of those exhausted to create a positive pressure within the building.

Heating large volumes of outside air can be very costly, and it is often not easy to justify heating this air. However, since worker health and comfort are important, these factors are being given more


Hook return
From shake-out
Cooling chain
Axiflo fan (exhaust)
North side
Outside air in
Up to roof
Exhaust duct
Supply duct
Axiflo fan (supply)
Casting unloading zone
PLAN
Fig. 2
Tapered duct
Adjustable vanes
Intake
Top of enclosure
SUPPLY DUCT
Fig. 2a
CASTING COOLING CHAIN
Adjustable vanes
Top of enclosure
Sheet metal air foil
EXHAUST DUCT
Fig. 2b

2 CASTING COOLING CHAIN is designed for 75 percent unheated outside air makeup. Figs. 2a and 2b show method used for distributing outside air into enclosure


Exhaust
Supply
Supply duct
Floor
SIDE ELEVATION
Fig. 3a
Supply
Exhaust
Cores
END ELEVATION
Fig. 3b
7 Propeller fans
CORE COOLING HOOD
PLAN
Fig. 3

3 THIS UNUSUAL SYSTEM uses both propeller and vaneaxial fans for cooling cones. Fig. 3a shows how air is supplied; Fig. 3b, pickup points where air is exhausted attention than in the past. This is where the introduction of unheated outside air should be given every practical consideration.

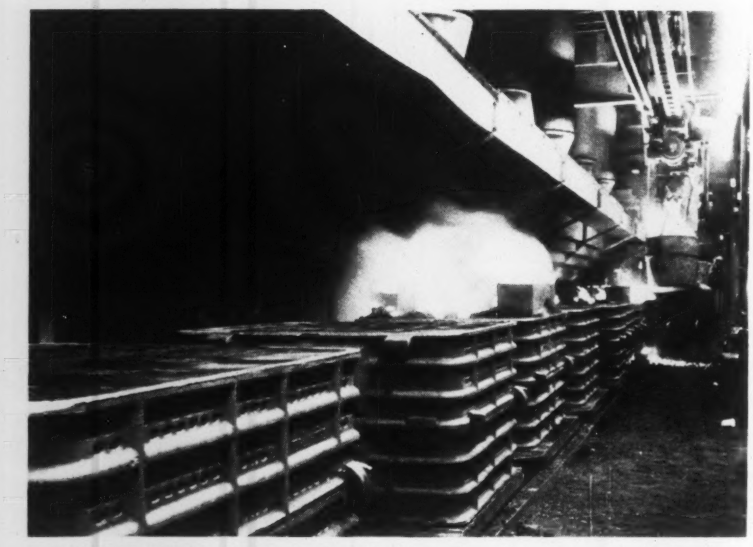
Limit Makeup to 80 Percent

Generally, it is recommended that unheated makeup air to an exhaust system be limited to about 80 percent of the amount being exhausted to the outside. This will prevent the escape of gases, fumes, etc., into the surrounding areas. The minimum amount which can be used will depend entirely upon the application, space limitations, etc. Flow of air must always be into the hood or enclosure.

The four systems described in this article have been in use for some time in the foundry facility at the Peoria, Ill., plant of Caterpillar Tractor Co., and have proved very satisfactory for the operations intended. Obviously, these are but a few of the exhaust systems being used in this building, but they should give the design engineer an idea of what can be done with similar systems in other areas to alleviate makeup air problems.

Fig. 1 shows a sheet metal enclosure designed for mold and casting cooling. Unheated outside air is introduced into the enclosure at one side and near the top. A vaneaxial fan incorporated in the outside air duct forces the air downward over the castings and molds, picking up heat, smoke, and gases from these sources. This is drawn up into the two exhaust hoods by means of the vaneaxial exhaust fans in the exhaust ducts and is discharged above the roof area. Fig. 1a indicates the adjustable vanes mounted within the outside air intake duct which can be set manually to obtain the general air flow pattern shown on the drawing.

In this system, 80 percent of the air volume being exhausted is made up with outside unheated air. The additional 20 percent required is admitted through the casting chain openings in the enclosure, as well as along one side where a continuous opening 12 in. above the floor is provided.



4 ONE METHOD USED in foundry for exhausting heat, gas, fumes from mold pouring area is pictured above and at right. Note above that smoke-laden air is moving toward exhaust intake, which is especially desirable during pouring process. Unheated outside air is discharged downward at front edge of hood. Section view (right) illustrates direction of flow to continuous exhaust plenum

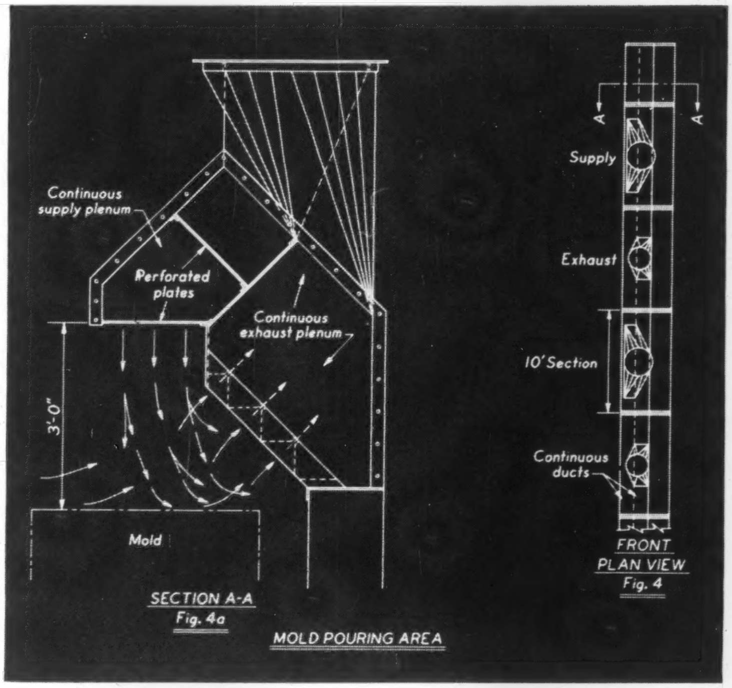
Fig. 1b is a detailed drawing of one of the exhaust hoods in which a sheet metal cylinder is used as an airfoil to ease the air into the hood. There are also manually adjustable dampers provided for regulating the air flow pattern. In this particular installation, it was not feasible to introduce the outside air along the two long sides of the enclosure, although it appears obvious that this would have been better from an air distribution standpoint.

Fig. 2 indicates a similar installation in another part of the foundry facility for casting cooling. The castings are placed on a chain, after the shake-out operation, make several passes through the sheet metal enclosure forming the cooling hood, and are unloaded on the far side. This system design called for 75 percent of unheated outside air makeup. The remaining 25 percent required is drawn through the various openings necessary for the cooling chain, as well as through a 30 in. high opening (near the floor) which is continuous along the east, south, and west walls of the enclosure.

Figs. 2a and 2b show the method used for distributing the outside air supply into the enclosure, and the airfoil design at the exhaust hood. Both ducts are fitted with manually adjusted vanes for balancing, and vaneaxial fans are mounted in the supply and exhaust air ducts.

Two Types of Fans

The system pictured in Fig. 3 is a bit more unusual. It uses both propeller and vaneaxial fans in its design for the cooling of cores. Unheated outside air is introduced into the plenum behind the four propeller fans and is forced through the several tiers of cores to the far side where it is again picked up by the other three propeller fans and thoroughly mixed within the enclosure. Both ends of



the sheet metal booth are open, allowing makeup of approximately 30 percent of the exhaust requirement to enter through these openings.

Fig. 3a shows the method used for supplying the outside air into the facility, while Fig. 3b indicates the four pickup points at the top of the booth where the air is exhausted. Each exhaust intake is divided into two curved inlets which are fitted with manually adjustable dampers for flow regulation. The four main pickup points are gathered into one main vertical exhaust in which the vaneaxial fan is located. Exhaust is through the roof.

Fig. 4 shows one method used in the foundry for exhausting heat, gases, and fumes from a mold pouring area. The 10 ft sections used on this particular installation indicate the alternate use of supply and exhaust ducts, each of which is fitted with its own vaneaxial duct fan. Supply and exhaust air plenums are continuous throughout the length of the installation (as indicated) and are limited only by space requirements. Any multiple of supply air and exhaust air sections can be added. This system uses a maximum of 75 percent of unheated outside air makeup in its design.

Fig. 4a shows a cross-section of the supply and exhaust air plenums, indicating the use of perforated plates for evenly distributing the supply air over the mold pouring area. Intake orifices at the entrance of the exhaust air plenum are designed to direct the air into the exhaust plenum at the right capture velocity.

Don't Admit Air Near People

There are a great many exhaust air systems which, through careful planning, could incorporate the use of unheated outside air. The prime requisite, which should be obvious, is that this unheated air must not be introduced into an area where personnel will be affected by it. For example, on a side hood the unheated outside air can be introduced at a point between the worker and the hood itself, to avoid discomfort.

There are a number of exhaust systems already installed today that can be altered economically to incorporate the use of unheated outside air. For installations in the planning stage, the use of makup air will be a big factor to consider in the design of exhaust systems. Every system that can use this principle will help to eliminate that ever-present culprit called "building negative pressure."

This article is intended to cover but one way of supplying makeup air into a building. Many other means are used to make up air in a building, among them:

1) Heating and ventilating units (packaged or built up on the site). This type usually incorporates the use of air distribution ducts, with vertical supply branches down into the occupied zones.

2) Gas-fired blower type units mounted within the trusses, with or without distribution ducts. Some of these units do not require venting to the outside air.

3) Unheated air may be introduced high in the truss area and pulled downward by the various exhaust air systems in the building. In installations of this type, personnel are not necessarily confined within the area, and spot heating, as necessary, is done with infra-red units spaced strategically for worker comfort.

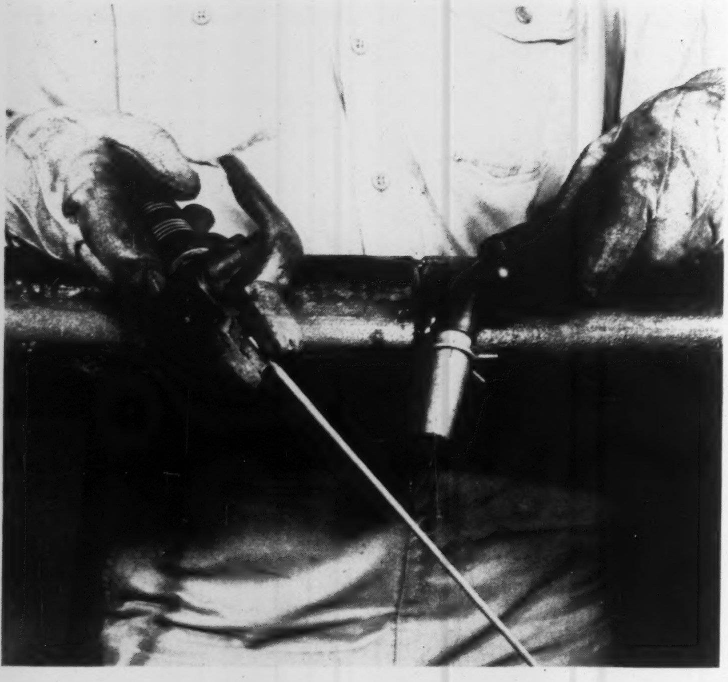
4) Steam coils can be mounted in the outside walls of the building (usually at the window level) or in the monitor sections. Various exhaust systems in the facility provide the means of introducing air, so heated, into the building.

Another article, to appear in an early issue will discuss the use of steam coils in outside walls, and monitors.

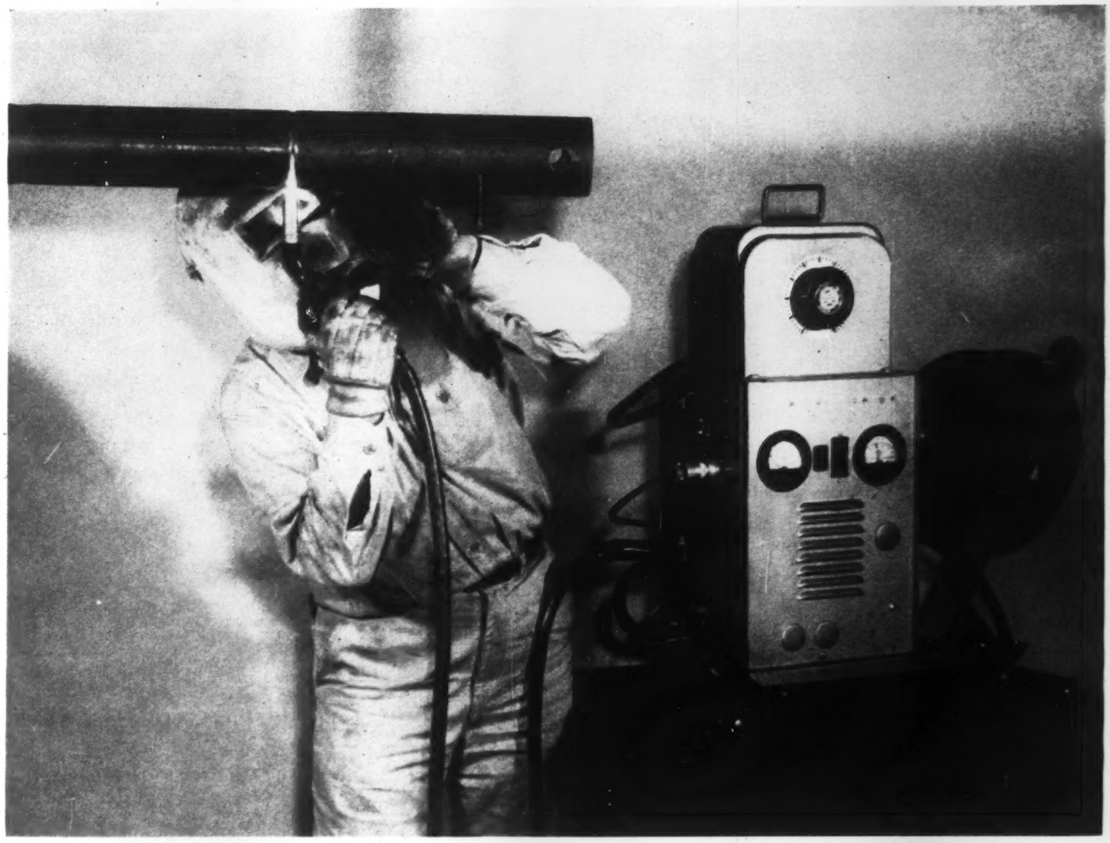
The author wishes to thank W. Huelsen of the Caterpillar Tractor Co. foundry engineering staff and others for their cooperation in the preparation of this article. ⌗

New CO_2 Gas Shielded Welding Saves Time, Money in Joining Pipe

• The pipe welding panel at the Mechanical Contractors Association of American convention in New York City last month has created interest in new methods to weld pipe better, faster, and at lower cost. One of the speakers at this session was Howard E. Cary, director of Hobart Brothers Co.'s technical school. A summary of his presentation on the new CO_2 gas shielded welding process for steel pipe is given here as one method for accomplishing a good weld at low cost.



1 MANUAL ELECTRODE and holder (left) and micro-wire gun (right) held by welder shows difference in size of electrodes. Weight of two pieces of equipment is same



2 WELDER USES MICRO-WIRE GUN in welding 5 in. pipe. Electrode wire is on reel at right. CO_2 gas is supplied from tanks (not shown) directly to gun through hose. Power for arc may be supplied by motor-generator or rectifier

A NEW CO_2 gas shielded welding process has been developed which uses gas at a greatly reduced cost. The CO_2 performs the same function as argon and helium in the "stick" welding process. Used in place of the manual electrode is a micro-wire electrode with a diameter of 0.020 to 0.045 in.

The arc voltage employed in the process is low, in the range of 16 to 20 volts, and the current is in the range of only 50 to 150 amperes d-c, reversed polarity.

The micro-wire gun is compared with a manual electrode holder in Fig. 1. The weights of these two pieces of equipment are practically identical.

At its present stage of development, this process is recommended only for P-1 carbon steel piping. Undoubtedly, this will be expanded to other groups of steel at a future date.

CO_2 gas shielded welding can be used in all welding positions. While it can be used in both uphill and downhill passes, the best results have been experienced with the downward position for the root pass. A pipe weld made in the horizontal (5-G) position, uphill on 8 in. Schedule 80 pipe, is shown in Fig. 3.

Aside from cost, another advantage of this new process is that cleaning between weld passes is not necessary. A glassy substance at the surface of each bead is developed with each pass, and welding right over this produces no bad effects. There is no slag other than this glassy substance.

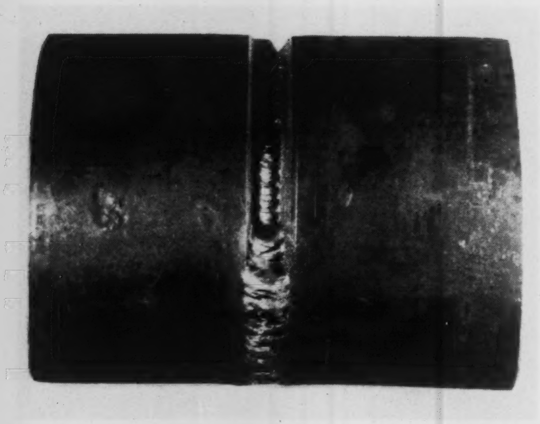
Normal joint preparation is all that is required. The fit-up need not be perfect, as the process will allow for flexibility unless the joint is too tight. No back-up ring is required, but there should be a good opening at the joint—within limits, of course.

This process *does* produce quality welds. Investigations have shown that CO_2 gas gives good protection against the atmosphere, resulting in sound metal which is free of nitrite and oxide inclusions.

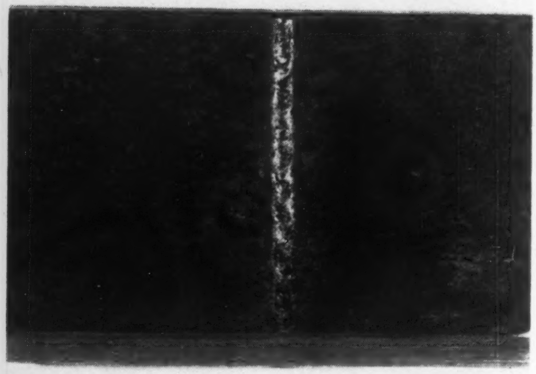
The process has been qualified by some fabricators to comply with the American Society of Mechanical Engineers boiler code for unfired pressure vessels. It is, of course, necessary that each fabricator qualify his own procedure and operators to the code involved.

Some Problems — and Why

If a CO_2 metal-arc weld should be unsatisfactory, there may be one or more welding conditions which must be corrected in order to obtain a satisfactory weld. Some



3 GROOVE AND INDIVIDUAL WELD PASSES shown here on 8 in. diameter pipe were welded in 5-G position, uphill with CO_2 gas shielded welding process



4 INSIDE VIEW OF ROOT PASS WELD on 8 in. diameter carbon steel pipe illustrated above. Weld was made in horizontal (5-G) position

weld difficulties and their possible causes are as follows:

1) Burn-through
    a) Current too high
    b) Excessive gap between work pieces
    c) Travel speed too slow or erratic
    d) Included bevel angle too large
    e) Nose too small
    f) Insufficient metal hold-down or clamping
    g) Improper backup (if used).
2) Crown (reinforcement) too high or too low
    a) Current too high or too low
    b) Voltage too high or too low
    c) Travel speed too high or too low
    d) Improper weld backing
    e) Improper work positioning.
3) Penetration too deep or too shallow
    a) Current too high or too low
    b) Voltage too high or too low
    c) Improper wire size
    d) Improper gas between plates
    e) Travel speed too slow or fast
    f) Connection for straight polarity
    g) Use reverse polarity (head positive).
4) Porosity and gas pockets
    a) Inadequate gas shield
    b) Too much gas shield
    c) Improper cleaning of work
    d) Contaminated weld backing
    e) Improper fit-up in welds with manual backing
    f) Moisture in gas
    g) Travel speed too fast.
4) Reinforcement narrow and steep-sloped (pointed)
    a) Voltage too low
    b) Wire feed too fast
    c) Stick-out (tip of work) too long.
5) Undercutting
    a) Improper wire position (fillet welding)
    b) Travel speed too high
    c) Improper weld backing.
6) Voids and cracks
    a) Improper electrode wire
    b) Improper cooling
    c) Failure to preheat
    d) Improper fit-up
    e) Concave reinforcement (fillet weld).

Good for Noncritical Piping

The CO_2 process is not recommended at this time for water clear x-ray work, but it does qualify under standard welding procedures. It is a natural for noncritical pipe fabrication. One disadvantage, however, is that it is a more complex process which involves more equipment. As a result, it is not as flexible as some other methods. It does have one big advantage, though: the skill of the welder need not be as critical as with some other processes.

But the major benefit is the reduced cost at which good quality welds can be made. Table 1 shows a cost comparison of two welding procedures on 8 in. Schedule 80 steel pipe welded in the horizontal fixed position. A saving of 53 percent was experienced with the CO_2 gas shielded process. ‡

TABLE 1 — COST COMPARISON of two welding procedures on 8 in. Schedule 80 steel pipe (wall thickness: 0.500 in.) shows savings of 53 percent with CO_2 gas shielded process. Pipe was welded in horizontal fixed position

	CO_2 gas shielded micro wire weld		Manual covered electrode	
Weld time, min.	22.20		43.30	
Cleaning time, min	0.00		7.06	
Total time, min.	27.42		57.89	
Operator factor, percent	81		73.4	
Labor cost	@ $4.00 per hr	$1.83	@ 4.00 per hr	$3.86
Electrode used, lb	1.33		2.25	
Electrode cost	@ $0.287 per lb	0.38	@ $0.15 per lb	0.34
Shielding gas, cu ft	5		0.00	
Gas cost,	@ $0.01 per cu ft	0.05	0.00	0.00
Total labor and material		$2.26		$4.20

Case Histories from a Consulting Engineer's Files

By C. T. BAKER
Consulting Engineer

Modern heating, piping, and air conditioning systems, for efficient and satisfactory operation, must be correctly designed. Here are two typical cases from the author's experience where original design was faulty and had to be corrected.

• the case of the low pH

REFRIGERATION was furnished to a meat processing plant by two ammonia compressors. A 30-ton atmospheric spray tower supplied condensing water. Makeup water was taken from city mains.

The cooling tower was located on the roof immediately above the compressor room, as was the multi-pass shell and tube condenser. A sausage smoke house of considerable size, located on the ground just opposite the cooling tower, was served by seven stacks that terminated at an elevation slightly above the mid-section of the tower.

Prevailing winds carried the CO_2 gas and the CO through the louvers and into the water spray as the water descended from the sprays at the top of the tower frame. Some of the CO_2 gas was absorbed by the sprayed water as it fell through the tower from the spray header at the top of the tower framework. The resulting mixture of air and CO_2 in the water was all that was required to produce a low pH.

The tower basin had not been equipped with a small drain to provide a continuous drain-off of the excessive solubles thrown down by the process of evaporation. This, plus a low pH, created a real problem, not only with regard to condensing pressures and condenser cleaning, but also a serious problem in deterioration of piping and condenser tubes.

The smoke stacks will be raised, the condensing water treated, and a continuous drain installed to hold down concentration. The wasteful conditions had existed for several years.

• redesign corrects explosion hazard

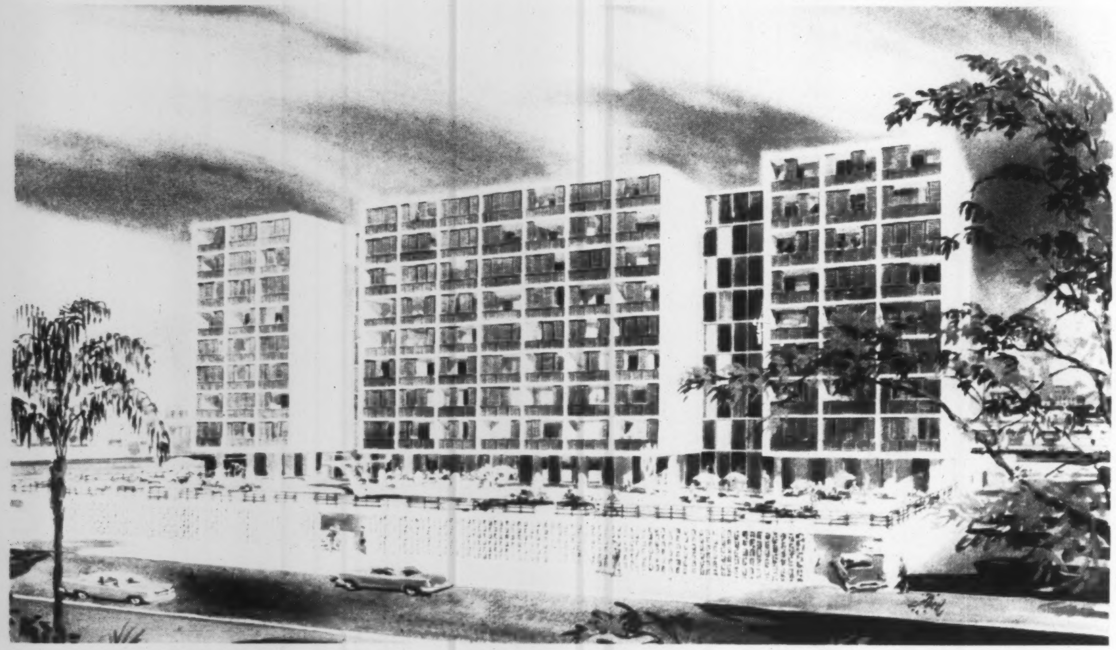
A SMALL air compressor delivering 14 cfm of air to a large diameter receiver was located in the compressor room of a meat processing plant.

The compressor was a two-stage unit. Air intake filters to each first-stage cylinder were located as close as possible to the cylinders. These were small filters, with but little surface for the air to pass into the cylinders. They were seldom cleaned.

Pressure loss through these filters was no doubt considerable, although unknown for the lack of appropriate gages. Just what the temperature of the air was as it left the fin cooler and entered the air receiver is not known since there were no thermometers to indicate these temperatures.

The compressor, operating at 800 rpm, was v-belt driven by a 15 hp motor. Air was discharged from the second stage of the compressor through a fin type air cooler located along one side of the unit. Heated air from this coil was blown directly across the compressor and was picked up by the suction intake at 114 F. The temperature of the air discharged from the high pressure cylinder of the compressor was over 500 F. The possible explosion hazard was increased because of the presence of ammonia gas which was picked up from occasional gas leakages around the two compressors and from other sources.

This situation is being corrected by extending a 6 in. diameter suction line to the outside of the machinery room and providing an air filter of large area in order to minimize the pressure drop between the filter entrance and entrance to the compressor. ‡



GULFSTREAM APARTMENTS, shown in artist's rendering, is typical example of Florida co-op apartment building boom. With some tenants occupying their apartments only during winter months, fair billing for air conditioning and heating is a problem

Individual Condensing Units Answer Co-op Apartment's Cooling Riddle

• With both window units and central station equipment judged unacceptable methods for air conditioning this new cooperative apartment building in Sarasota, Fla., a scheme was devised whereby individual air cooled condensing units were installed in batteries of nine units each on each of eight floors. A single unit serves one apartment in the building. A meter bank adjacent to each group permits individual metering. Thus, equitable billing—a problem of central systems in this type of structure—is provided, and the disadvantages of window units are avoided.

Mr. Smith, a 1940 mechanical engineering graduate of Stevens Institute of Technology, gained his early experience with such companies as duPont, Eastman Kodak, and Airtemp Construction Co. Since 1953 he has been an independent consulting engineer with offices in Miami and Sarasota, Fla. The majority of his work has been in the design of heating and air conditioning systems for large commercial and industrial buildings.

By LOUIS H. V. SMITH
Consulting Engineer

COOPERATIVE apartment buildings are going up all over Florida these days and nearly all of them are air conditioned. Some have sprouted window units, with consequent lack of esthetic appeal. Others have been built with central station equipment, but have cumbersome billing or metering arrangements.

Window air conditioning units have the advantage of making it easy to charge the particular tenant for maintenance and power use. But there are the definite disadvantages of (1) increased maintenance problems due to spread-out equipment, (2) increased noise from compressors adjacent to living quarters, (3) lack of flexibility of furniture arrangement by the tenant, and (4) limitations on the architectural design of the building exterior.

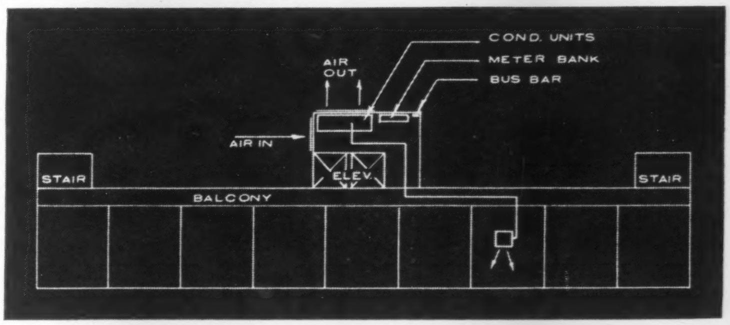
Central station equipment, of course, has the advantage of easy maintenance and noise control. With the basic equipment in one location, operation can be checked as often as necessary and corrections can be made before failure occurs. In addition, the compressor can be acoustically insulated from the building to maintain quiet in the living areas.

But there is the ever-present problem of billing equitably for heating and cooling. If a flat charge per month is made, the tenant who only uses his apartment for the winter—and there are many of these in Florida—pays an unfair share. If a metering system is used, there is the inconvenience of periodic reading and bookkeeping which must be added to the work load of apartment personnel.

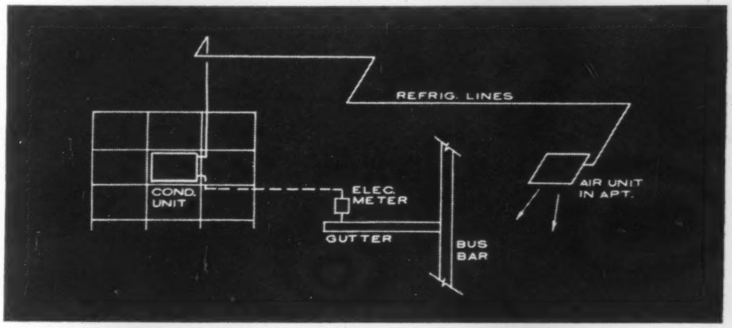
In the preliminary planning for Gulfstream Apartments, Sarasota, it was found that neither window units nor central station equipment would be acceptable to the owners for the reasons cited above.

There were certain fundamental qualifications to be met by an acceptable system. Each apartment dweller is entitled to separate control and separate billing by the power company for the time the equipment is used. Maintenance and noise level requirements dictated a central location for compressors and condensers.

Since the building shape is as shown in Fig. 1, the most economical space for both air conditioning and electrical equipment was behind the elevator tower. Electrical distribution is from a vertical bus bar the height of the building.



1 PLAN VIEW of building shows air conditioning equipment, meters located behind elevator tower. Electrical distribution is from vertical bus bar which runs height of building



2 REFRIGERANT LINES, low voltage control wiring run above ceiling of rear balcony to each apartment air handling unit. Removable panel ceiling permits easy maintenance

With nine apartments per floor, it was possible to install nine electric meters, nine disconnect switches, and nine air cooled condensing units on each floor.

The condensing units are installed to provide reverse cycle operation so that heating or cooling would be at the option of the tenant. Air is brought in through louvers in the side wall and discharged through louvers at the rear.

In order to simplify maintenance of the condensing units, an angle iron rack holding nine units was designed for installation on each floor. With the cooperation of the air conditioning equipment manufacturer, each unit, regardless of capacity, was mounted on the same size base so it could slide into its space in the rack.

Thus, by installing line refrigerant valves and a plug-in electrical connector, any unit can be disconnected in a few minutes and removed from the rack for maintenance. A replacement unit can just as easily be slid into place and connected to the refrigerant and electric supplies.

Refrigerant lines and low voltage control wiring were installed above the ceiling of the rear balcony to each apartment air handling unit. This is shown schematically in Fig. 2. A removable panel ceiling gives ready access to these lines in case of leakage. With this arrangement, all maintenance and repair work, except for the air handling unit or the thermostat, can be performed without entering the apartment.

With nine units on each of the eight floors, Gulfstream Apartments fitted into an easily managed pattern. A similar arrangement of equipment would adapt to most high rise apartment buildings with like requirements. ‡

Proper Fuel Preparation Is the Key To Efficient Fuel Oil Combustion

• The combustion efficiency of highly viscous fuel oils ultimately depends on proper fuel preparation so that they will be delivered to the combustion chamber sufficiently atomized and at the right temperature. A major step in designing for fuel oil combustion is the evaluation of the temperature-viscosity relationship necessary for peak efficiency. By knowing the limitations of the equipment in a plant and through the proper preparation and utilization required, a viscous fuel oil can be handled and used efficiently.

By D. S. FRANK
Assistant Refinery Technical Manager
in Charge of Utilities
Pure Oil Co.

FUEL OIL BURNING is still more of an art than a science. It is the intent of this article to approach the subject from the viewpoint that the ultimate combustion efficiency in the use of fuel oil stems from proper fuel preparation. According to the dictionary, *fundamental* is defined as a principle, rule, or law which serves as a groundwork of a system. The groundwork of efficient fuel oil burning consists in, first, preparing and, second, burning the fuel in a properly designed combustion chamber.

Although this article is primarily concerned with No. 6 fuel oil, the comments apply to No. 5 fuel oils as well as to higher viscosity fuels.

There are a few important specifications of fuel oil which must be recognized. Quite often, proper perspective of the relative value or interpretation of certain specifications is not properly evaluated.

A glance at the National Bureau of Standards specifications[1] for No. 6 fuel oil provides little information. This specification identifies No. 6 oil as being "for use in burners equipped with preheaters permitting a high viscosity fuel." Viscosity is stated as 45 Saybolt Furol seconds* as a minimum and 300 seconds as a maximum. Flash point is 150 F minimum. Water and sediment are 2 percent maximum. This is a sum of the water by distillation and sediment by extraction. Maximum sediment by extraction shall not exceed 0.5 percent.

The best known properties of fuel oil are gravity, heating value, viscosity, flash point, pour point, sulfur content, and ash content. Some attention is now being given to metals content of the fuel. All these tests are performed under controlled laboratory conditions. The relative importance of these properties depends upon the use of the fuel oil.

These properties vary, depending on the sources of crude oil and the refining process involved. Gravity generally varies from 5 to 15 deg API[2]. However, fuel oils of both lower and higher gravities are marketed as No. 6. Gravity is important only because it designates the heat content per pound or gallon. The Btu content per gallon is determined from the weight of the oil as denoted by the gravity and the heating value per pound. The lower the gravity, the higher the heat content per gallon and consequently the lower cost per million Btu. However, the full potential may often not be realized unless other factors influencing the end result are carefully engineered.

The minimum permissible flash point is usually regulated by federal, state, or municipal laws and is based on accepted practice in handling and use[3].

The significance of pour point in a viscous oil is relatively unimportant, as the oil must be heated to insure proper handling.

Sulfur may or may not be important, depending on the equipment in which the oil is being used. In some process work, low sulfur fuel may be essential. When used as a boiler fuel, the sulfur content must be evaluated against higher potential maintenance of economizers and air heaters. The effect of sulfur in conjunction with metals content and ash may influence superheater tube deposit in high temperature, high superheat boilers.

From a user's standpoint, viscosity of the fuel is an important quality and may not be fully evaluated. As mentioned previously, the National Bureau of Standards specifications carry a minimum and maxi-

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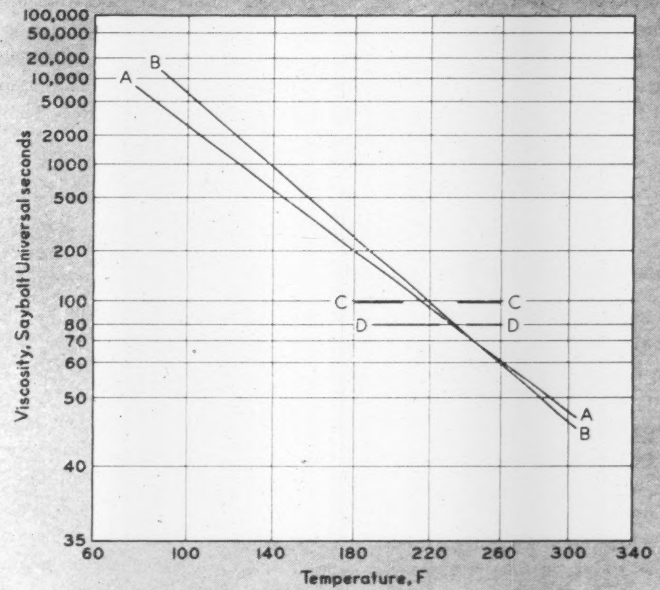
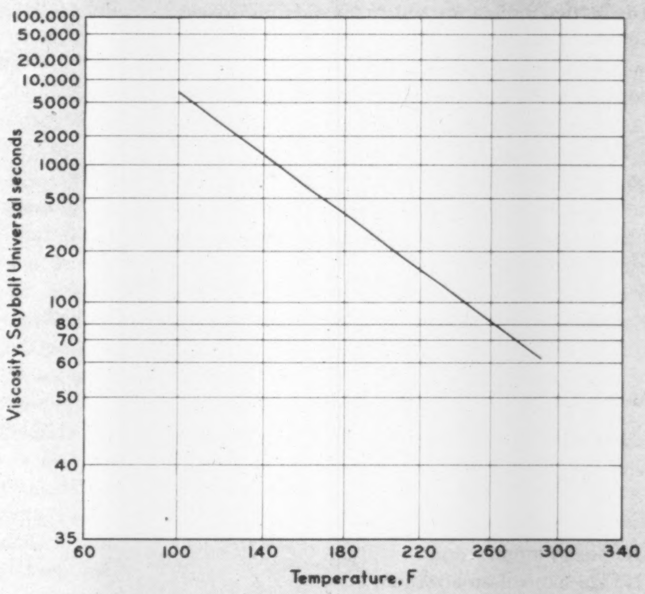
[1] Numerals refer to references on page 146.

*The relationship between Saybolt Universal viscosity seconds and Saybolt Furol viscosity seconds at the same temperature has been taken as 10 to 1; that is, 3000 Saybolt Universal seconds is equivalent to 300 Saybolt Furol seconds. For all practical purposes, this involves no appreciable error and is generally accepted as sufficiently accurate.



1 VISCOSITY-TEMPERATURE relationship shown here for two different oils *A* and *B*. Line *C-C* designates maximum recommended viscosity; *D-D* is minimum. Minimum viscosity, which should always be used for best combustion, is obtained by preheating oil to temperature shown on curve



2 IMPROPER COMBUSTION, coke buildup were corrected by decreasing viscosity from 300 to 150 Saybolt Universal seconds on one installation using fuel oil with viscosity-temperature relationship shown here. To do this, oil had to be heated from 188 to 220 F

mum specification for viscosity. Any fuel oil falling within this range is therefore characterized as a No. 6 fuel oil. With the great range permissible, a user can be at a loss to determine optimum temperature required at the burner nozzle.

Since the permissible viscosity of No. 6 fuel oil can range from a low of 45 seconds to a high of 300 Saybolt Furol viscosity at 122 F, [illegible] is essential to know the slope or viscosity index. This is determined by obtaining an additional viscosity. On No. 6 oil this second determination is made at 210 F. The ASTM Standard Viscosity-Temperature Chart is so constructed that, for any given petroleum oil, the viscosity-temperature points result in a straight line. The viscosity at any temperature can then be determined from this line.

Let us presuppose that heated storage, proper size lines, adequate pumping facilities, suction, and discharge strainers have been provided. This article is then concerned with the final degree of preparation of the fuel.

Increase Surface Area by Atomization

As stated by J. R. Joyce[4], the reason fuel oil will not burn in bulk or in coarse droplet form is that there is insufficient liquid surface exposed to air. Atomization breaks up the bulk liquid into a host of tiny droplets, causing a greatly increased surface area of the liquid to be exposed to the air. Small droplets in a spray are extremely important since they ignite readily and, if sufficiently numerous, provide a basis for the chain reaction upon which continuous stable burning of the spray depends.

An oil burner has three functions: (1) to split the fuel oil into a vast number of small drops (the smaller the droplet size, the more efficient the burning); (2) to introduce and mix the air for combustion of the fuel oil; and (3) to shape the flame to conform to the firebox in which the fuel is burned. These three requirements must be met, regardless of the type of oil burner used.

According to R. P. Fraser[5], the characteristic flame in an oil fired boiler is not premixed. It is a stationary diffusion flame in which the vaporized oil burns as it comes in contact with the air. In this type of burning there is a steady change in chemical composition as the fuel and air pass through. The rate of burning is determined by the rate of mixing by diffusion or turbulence and, more often, by the aerodynamic movements in the combustion chamber.

Burners Fall into Three Groups

Burners are classified according to the method used for securing atomization and fall in three general groups:

1) Air atomization (either low or high pressure)
2) Steam atomization
3) Mechanical atomization.

The subject of burners is amply covered in the literature[6]. For large boilers, the trend is toward either high pressure mechanical atomizing or steam atomizing burners. For small industrial boilers, a low pressure mechanical atomizing burner such as the spinning cup performs satisfactorily. In process furnaces, the type of product can influence the type of burner for the job; normally a low pressure air atomizing burner is used.

According to A. L. Cude[7], a turbulent stream of gas is not homogeneous in structure, but may be considered as a succession of separate particles of gas. These parcels have random motion in all directions superimposed on the steady motion in the direction of flow. These random motions produce a jostling action which causes neighboring parcels to exchange gases constantly so that mixing takes place. A flame differs from the above simple system because it results from the mixing of two fluids of different densities (both of which may be turbulent) under conditions in which natural convection due to difference in temperature will promote mixing.

Each type of burner has its limitation of maximum operability of viscosity. All references to desirable viscosity are at the burner tip. Too often, preheaters are located at some central point and the desired temperature may be obtained at the preheater outlet. But the oil may lose temperature enroute to the burner. This is quite true in industrial plants where oil lines may be long or improperly insulated.

For example, a well-designed internal mix steam atomizing burner will operate at 250-300 Saybolt Universal seconds if dry steam of sufficient pressure and temperature is available to break up the oil. The smaller the droplet issuing from the tip, the greater the surface area available to the air. However, it is the author's experience that a viscosity of 150 Saybolt Universal seconds at the tip will provide a finer spray, more intimate mixing with air, and a shorter flame.

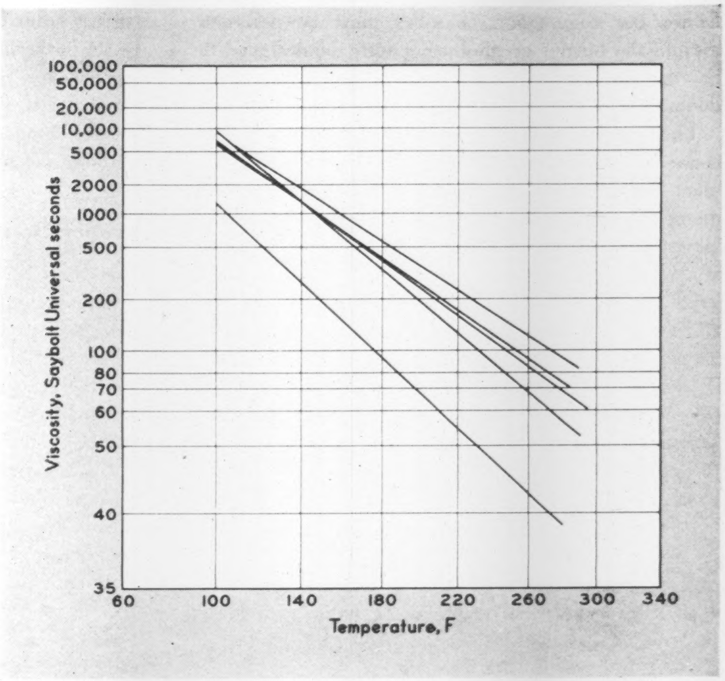
Mechanical spray plate burners operate most efficiently at a viscosity of 150 Saybolt Universal seconds.

Spinning cup burners and low pressure air atomizing burners are very sensitive to viscosity. In a recent experience with a low pressure air atomizing burner, trouble was experienced with soot deposit on the product. In this instance, the temperature of the oil leaving the steam preheater was 200 F, which corresponded to 130 Saybolt Universal seconds viscosity. The manufacturer's literature recommended a viscosity at the tip of 80 to 100 seconds. This particular oil had a viscosity of 102 seconds Saybolt Furol at 122 F — a rather low viscosity for a No. 6 fuel oil. The temperature-viscosity data on this oil showed that it should be heated to 215 F to obtain a Saybolt Universal viscosity of 100 seconds, and required a temperature of 232 F to obtain the desired viscosity of 80 seconds. When the temperature was raised, an improved condition was obtained.

Use Minimum Recommended Viscosity

Fig. 1 shows this relationship. Line *A-A* represents the oil discussed and line *B-B* is another fuel oil which is also used. Line *C-C* designates the maximum

3 VISCOSITY-TEMPERATURE data for five fuel oils indicates range of characteristics. Bottom line represents an oil close to No. 6 fuel oil. Note sharp decrease in viscosity with increase in temperature



recommended viscosity and line *D-D* the minimum. When a range is specified, it is preferable to use the minimum.

It is of interest to note that, although the fuel designated by line *B-B* had a viscosity of almost 1000 Saybolt Universal seconds more at 122 F, the temperature-viscosity line intersects the line of the lighter oil at about 245 F. In other words, at a viscosity of 80 seconds, both oils required about the same degree of preheating.

On another job, trouble was experienced with coke buildup in the Morrison tube of a scotch marine boiler fired with a spinning cup type burner. The oil used had a viscosity of 246 Saybolt Furol seconds at 122 F. The manufacturer's recommendation was 300 seconds Saybolt Universal for proper atomization. This corresponded to a temperature of 188 F. In order to improve conditions, it was necessary to go up to 220 F, which gave a viscosity of 150 seconds at the burner tip. The viscosity-temperature relationship for this fuel is shown in Fig. 2.

On spinning cup burners, the position of the primary air nozzle has a bearing on flame contour. In the last example, it was found that the air nozzle was not in the correct position with relation to the tip. Also, on inspection, the nozzle was found to have been damaged. Raising the temperature of the fuel oil, adjusting the air nozzle, and replacing the oil cup provided improved burning.

Fig. 3 shows the temperature-viscosity data for a number of different fuel oils. The top line represents a fuel oil which has been used in one of our own plants and from the viscosity of 350 Saybolt Furol seconds at 122 F exceeds the specification of a No. 6 oil.

The bottom line represents an oil quite close to the minimum specification of a No. 6. The fuels represented by the second and third lines have approximately the same viscosity at 122 F, but different viscosities at 210 F. For all practical purposes both oils will handle the same.

On the other hand, the oil represented by the fourth line has entirely different characteristics. The viscosity of 280 seconds at 122 F is quite close to the maximum permissible viscosity. However, the viscosity decreases rapidly with an increase in temperature.

There should be no apprehension of burning high viscosity fuel oil provided adequate equipment has been installed. In discussion of the Linden Generating Station[8], high viscosity fuel is supplied at 1000 psig and 450 F.

Burner, Firebox Must Be Compatible

After the oil has been properly conditioned, the fuel can be utilized efficiently only if the burner and the firebox are compatible. This "if" is a factor of considerable importance. Since fuel oil is primarily 83 to 89 percent carbon and carbon requires time to burn, ample free space must be provided for completion of burning at the rate required for the job.

Either the combustion chamber must be designed around the burner or the burner must be designed to fit the combustion chamber. Normally the latter is done.

The flame should be completely burned before it comes in contact with a cool surface. Any impingement on tube surface or refractory will exert a quenching action and tend to disturb the oil-air mix. This will throw the unburned carbon out of the flame and result in formation of coke on the cooler surface, promoting a tendency to smoke. Once coke formation starts, the buildup proceeds at an ever-increasing rate as the area for flame expansion becomes smaller.

Length and width of flame at its greatest area can be controlled by tip size, angle of spray, and turbulence of burning. Heat release can vary from 500,000 to as high as 1 million Btu per ft of flame length. In a short firebox, it is desirable to obtain a high release per foot of length in order to prevent flame impingement on the rear wall. This calls for a wide angle flame pattern. In a long narrow firebox it would be desirable to lengthen the flame with lower heat release per foot of flame length.

Coke Formation: Its Causes, Cures

One of the most common complaints about "poor fuel oil" is the formation of coke. Some of the causes and suggested remedies are:

1) The oil has not been preheated to the temperature required for efficient atomization, allowing oil to dribble.

2) The atomizer cup, sprayer plate, or tip is worn. This permits an unequal amount of oil to leave each orifice, resulting in some heavy streams of oil in part of the periphery and lean mixtures in other sections. The remedy is to inspect tips often and replace at the first sign of poor flame distribution. When using multiple hole tips, make sure the holes are not out of round.

3) The burner may not be centered in the refractory cone.

4) Insufficient primary air may permit flame to backlash on refractory.

5) The tip or cup may be at improper angle. These important parts of the burner come in various angles. If the flame is impinging on the refractory cone and air supply pressure has not fallen off, change to a tip with a smaller included angle. This will tend to straighten the flame out. However, the flame pattern should fill the refractory cone, otherwise the spray will not cut the air stream.

6) Adjust the position of the burner so that the flame just clears the refractory cone. If the flame tends to impinge on the cone, coke will form. If the burner is inserted too far into the cone, it will result in long flame length and higher excess air. Once the correct point is established, the burner should always be set in the same position.

7) Don't push a burner much beyond its rated capacity. If you do, the quality of atomization decreases, flame length increases, burner efficiency decreases, and the potential of coke deposition increases.

Proper Design Can Handle High Viscosity Oil

High viscosity fuel oil should not create a problem in a plant that has been properly designed and equipped to handle it. When designing a plant or revamping an existing plant, provide ample preheating facilities to use efficiently the maximum fuel oil viscosity specification. For some time, this has been 300 Saybolt Furol seconds.

By the trial and error method, it is possible to determine the temperature required for efficient atomization. But a temperature-viscosity curve provides a more positive approach.

Do not put needless restrictive specifications on a fuel. It is preferable to use normal specification material as this increases the number of potential suppliers and keeps the cost of fuel oil in line. If the oil equipment is not designed for No. 6 fuel oil, continue to use the lighter viscosity material until such time as required changes are incorporated in the fuel system to permit use of a more viscous grade.

Maintain the equipment in good condition. Inspect tips and nozzles frequently, and use proper precautions in cleaning. A dirty tip or nozzle or a partially plugged air cone prevents proper fuel utilization. Do not clean oil tips with drills which can disturb the size of the holes in a tip and change the angle of spray. Replace burner refractory blocks as required. When patching is done, be sure the original contour is maintained.

Check the equipment. Do not be too quick to blame the fuel oil until a thorough inspection indicates proper maintenance has been performed. ∓

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This article is based on a paper presented at the recent meeting of the American Power Conference in Chicago.

Apartment Building's Negative Pressure Gulps Smoke From Incinerator Doors

By G. H. HAMA and
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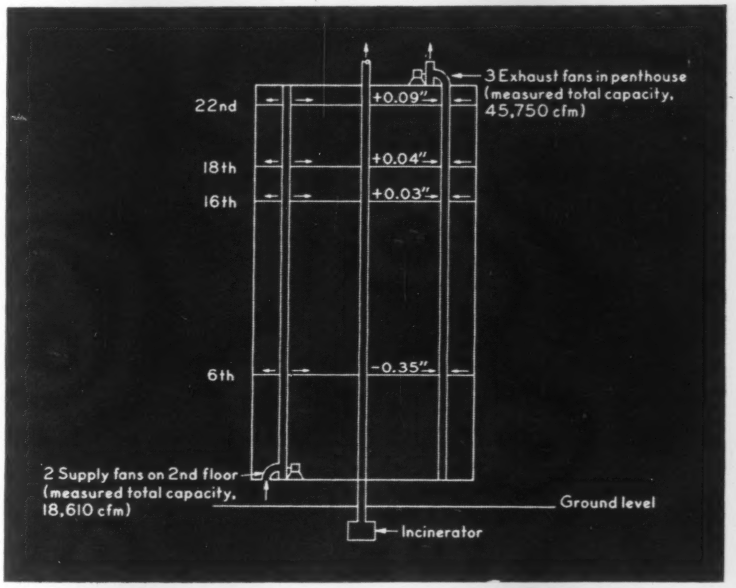
Department of Health
City of Detroit


3 Exhaust fans in penthouse (measured total capacity, 45,750 cfm)
22nd
+0.09"
18th
+0.04"
16th
+0.03"
6th
-0.35"
2 Supply fans on 2nd floor (measured total capacity, 18,610 cfm)
Ground level
Incinerator

STATIC PRESSURE READINGS, taken at various levels in this 22-story apartment building, point to negative pressure on upper floors as reason that incinerator stack was not functioning properly. Readings were taken with all fans operating

How CAN smoke be kept from escaping through incinerator doors into the living areas of a multistory apartment building? Recently, the Detroit Dept. of Health was called upon to assist the owners of an ultra-modern apartment building in solving just such a problem. The incinerator stack (20 in. in diameter) runs vertically through the center of the 22-story building. Tenants on each floor have access to the incinerator stack for convenient disposal of trash.

No problem existed on the lower 17 floors, but when stack doors on each of the upper five floors were opened, smoke would billow out, carrying with it soot and garbage odor. When stack doors were closed, the smoke and dirt would seep in around the door edges into the hallways and apartments.

In one instance, a tenant, mistaking the incinerator odor for a fire, called the fire department.

The owners of the building had installed magnetic locks to keep tenants from opening the stack doors while the incinerator was in operation. Rubbish was placed in containers and picked up and burned in batches by an attendant during the day—not a very efficient or cheap method of collection and disposal. And even with the magnetic door locks the smoke continued to escape.

Static pressure readings were taken at the stack doors on various floors. A manometer hose was inserted into the crack at the stack doors, while the other leg of the manometer was in the hall. Next, pitot tube traverses were taken of the air flowing from and to the supply and exhaust fans, respectively. The data obtained showed that the actual total exhaust measured 45,750 cfm, against a designed exhaust of 59,100 cfm, and that the actual total air supply was 18,610 cfm against a designed 17,400 cfm.

It was obvious from this data that the building was under negative pressure—preventing the incinerator stack from functioning. This was confirmed by the fact that when the exhaust fans were turned off the stack functioned properly.

It was recommended that the incinerator stack be power exhausted with approximately 4500 cfm to prevent seepage of smoke around the incinerator doors.

An alternative might have been to increase the supply air. However, the existing duct sizes may be too small and there is no room for larger ones. Another might have been to provide openings in the outside wall and louvers in the stairway doors. The stairways would act as a plenum for distributing the air. However, the expense of providing openings in the outside wall and the resultant cold drafts would make this method a poor choice.

As a result of this study, it was concluded that it would be wise, in designing an apartment building with a central incinerator, to keep the supply and exhaust in balance or provide a means to prevent negative pressures in the building. ‡

How to Select Boiler Feed Pumps

Correct choice requires thorough analysis of several factors

• One of the major decisions that must be made in the design of any large boiler installation is the selection of boiler feed pumps and drives. Several factors must be considered to arrive at the design which will give optimum dependable performance at the lowest cost. Such an analysis, made recently for the pumps and drives to serve a new 265,000 kw electric utility power plant, is reported in this article.

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and
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SINCE its earliest days the electric utility industry has been remarkably successful in overcoming rising material and labor costs. This has been possible principally through the development of more efficient power plant cycles. With the progressive development of steam turbine-generators devoted to electric power generation, it is becoming increasingly apparent that efficiency gains are being obtained at a rapidly diminishing rate. Consequently, the lesser gains in efficiency with the higher attendant material and labor costs (accentuated by inflation) have intensified interest in investigations of all basic components of a power plant.

One of the more vital components in the electric utility power plant cycle is the boiler feed pump. With the ever-increasing need for electrical energy and with the constant striving for the lowest energy cost, unit sizes are becoming larger, and higher initial pressures are being utilized. The larger capacity pumps that are required place a greater significance on obtaining the most economical combination of pumping equipment and drive for a particular application.

The three basic boiler feed pump drives for large capacity units are: (1) electric motor, (2) auxiliary steam turbine, and (3) main turbine-generator shaft. A number of successful arrangements of pumping equipment have been evolved with each type of drive and numerous papers have been written on their relative merits. The size and type of turbine-generator, load variations, and fuel cost are some of the factors which influence the final choice of equipment.

This article presents the results of a study that was made in selecting the most economical boiler feed pump and drive arrangement for a 265,000 kw unit, one of two to be installed at a location in the Great Lakes region. Steam conditions for these units are 2400 psig pressure, 1050 F at the throttle, and 1000 F reheat. Each unit will be a 3600 rpm cross-compound four-flow type. The first unit is scheduled to be placed in operation in 1962 and the second a year later.

As a basis for evaluation, the following criteria were established:

1) The net kilowatt capability with any of the boiler feed pump drive arrangements to be the same.

2) An average unit capacity factor of 0.63 for a 35-year life.

3) An expected coal cost of 40 cents per million Btu at the start-up date, increasing at the rate of 2 percent per year for the 35-year life.

4) Comparable reliability of arrangements as far as possible. When this is not possible, an outage penalty for the anticipated difference in downtime is applied.

5) A main turbine-generator exciter to be driven off the main turbine-generator shaft with any boiler feed pump drive arrangements.

6) Fixed charges to be at a rate of 15 percent.

The basic thermal cycle selected has three low pressure heaters, a deaerating heater, and four high pressure heaters — all in series. The three half-size condensate

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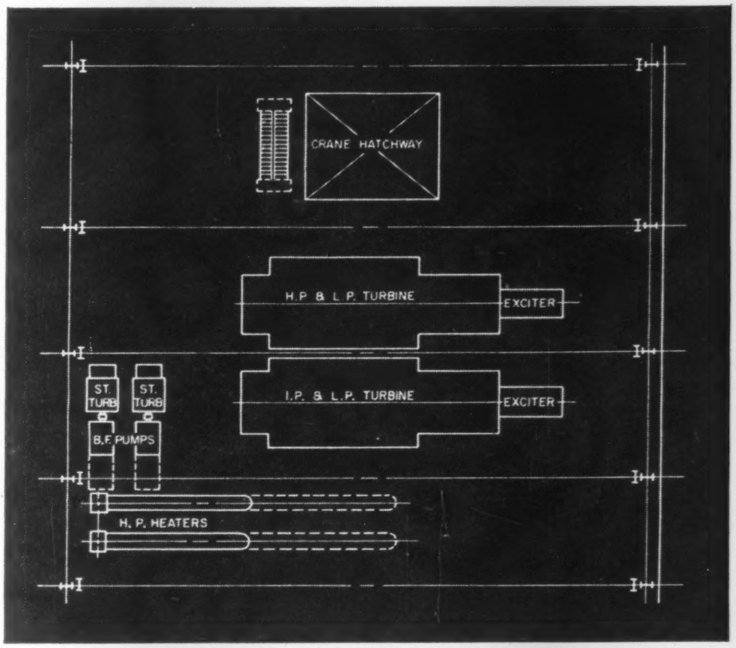
This article is based on a paper presented at the 1960 American Power Conference in Chicago.

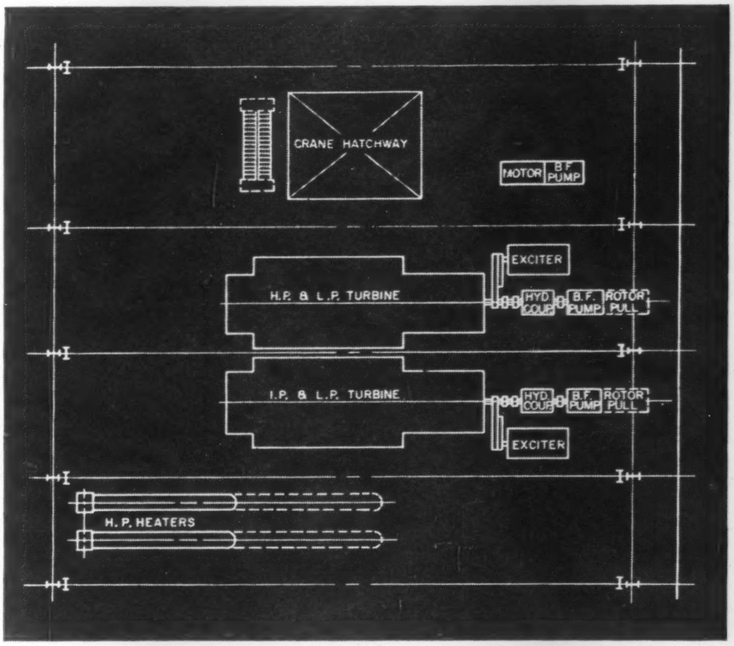
pumps taking suction from the condenser hotwell will discharge through the low pressure heaters to the deaerating heater. The boiler feed pumps will take their suction from the deaerating heater and discharge through the four high pressure heaters to the steam generator.

It was originally thought that, with the deaerating heater located at an elevation approximately 90 ft above the operating floor and 130 ft above the basement floor, feedwater booster pumps would not be required. With the motor driven pumps in the preferred location at the basement level, this proved to be the case, even with pumps having speeds above 3600 rpm.

The preferred location of the auxiliary steam turbine driven pumps was on the operating floor, as shown in Fig. 1, where the equipment would be under control and close scrutiny of the control room operator. The main turbine-generator shaft driven pumps would, of course, be located at the operating floor level, as shown in Fig. 2. With the latter two methods of drive, booster pumps would not be required with 3600 rpm pumps, but would be needed with higher speed pumps to insure adequate net positive suction head.



1 OPERATING FLOOR PLAN of 265,000 kw unit shows arrangement of auxiliary turbine driven boiler feed pumps



2 MAIN TURBINE-GENERATOR driven boiler feed pump arrangement shown in this floor plan

Study Drive Arrangements

Since various combinations of boiler feed pumping equipment have proved to have comparable reliability, a study was made to determine the most economical combination with each of the three basic drives. These in turn were compared to arrive at a final selection.

In undertaking this phase of the study, it was recognized that the prevailing market situation could influence the final selections if competitive bids were obtained on each item of equiment. Moreover, the task of evaluation would be prohibitive with the large number of permutations possible. Following selection of the most economical arrangement of boiler feed pump and drive, competitive prices could be obtained for further evaluation.

Seven different arrangements of electric motor driven boiler feed pumps were considered. These arrangements included half-size and one-third-size pumps, constant-speed and variable-speed equipment, 3600 rpm and higher speed pumps, and 3600 and 1800 rpm motors.

It was concluded that the most economical motor drive arrangement would be with two one-half-size, 5400 rpm, constant speed pumps, each driven by an 1800 rpm motor through a speed increaser.

How Pumps Were Studied

The following is a brief resume of the studies made which led to the above conclusion:

Because of the proven reliability of boiler feed pumps, no spare pumps were considered necessary. However, to minimize the duration of the possible forced outages, a spare inner pump assembly and a spare motor were included in the cost comparison. These spares would also serve the second unit addition and thus reduce the cost applicable to the first unit.

A full size motor driven pump was not considered, due principally to the heavy burden it would impose on the auxiliary power supply system, especially during startup.

A characteristic of constant speed boiler feed pumps is that when flow decreases the head increases. In a feedwater system, however, the head decreases as the flow decreases. It is therefore necessary to dissipate the pressure difference by throttling, and this represents a waste of power.

To a certain extent, with constant speed pumps, this waste of power can be reduced by dividing the full capacity among two or more pumps. Furthermore, the greater the number of pumps installed, the less the loss of load when one pump is forced from service. Accordingly, two one-half-size *vs* three one-third-size pumps were considered.

With the one-half-size pumps, loss of one pump would reduce the output of the turbine-generator unit to about two-thirds load. Loss of one one-third-size pump would only decrease the load carrying ability of the turbine-generator unit to about 85 percent of rating, and loss of two one-third-size pumps would still allow the remaining pump to maintain 50 percent of turbine-generator load. A cost study indicated that the two one-half-size pumps with a spare inner assembly and a spare motor would represent the more economical investment, although not by a wide margin.

A comparison of variable speed and constant speed pumps in the 3600 rpm class showed that the added cost of a variable speed coupling could not be justified by the moderate savings in power. It was anticipated with one-half-size pumps that one pump operation would be utilized when the load dropped below 60 percent of turbine-generator capacity for extended periods, such as during the night and weekends.

The higher than 3600 rpm speed pump driven by an 1800 rpm motor through a speed increaser was selected, based on its lower combined equipment cost compared to the 3600 rpm pump driven by a 3600 rpm motor.

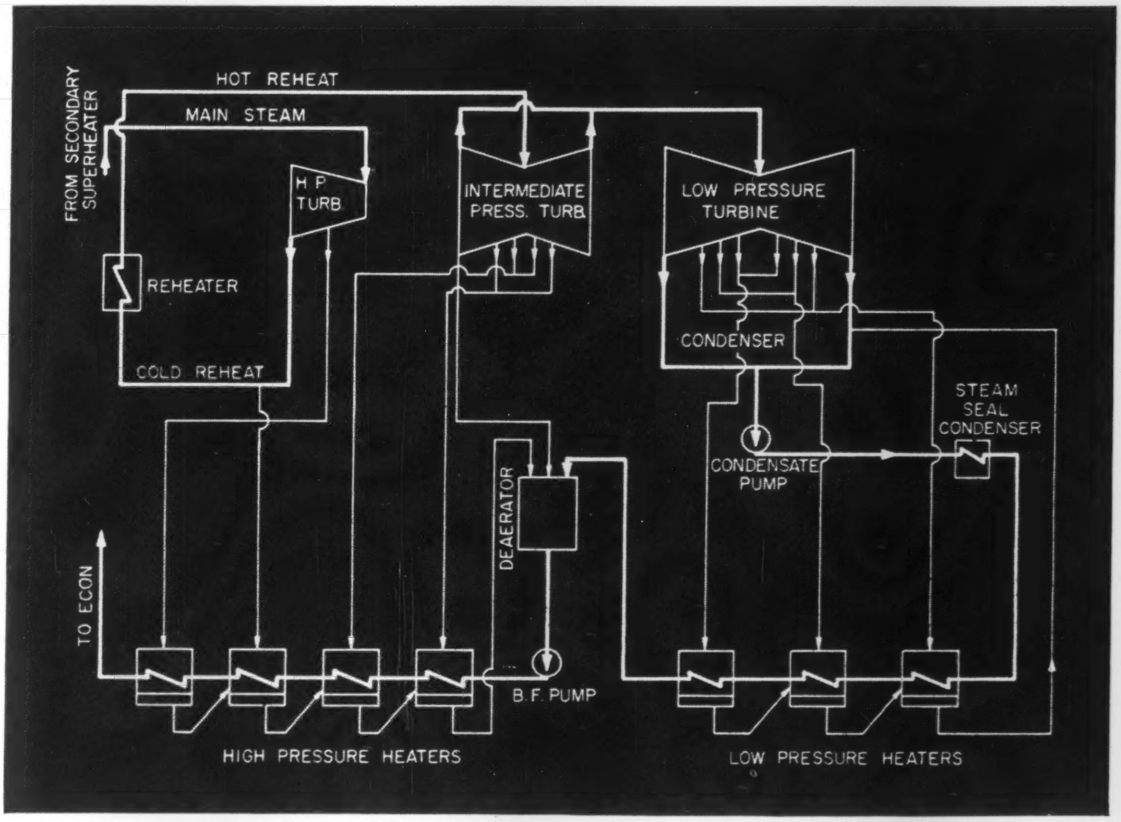
Compare Auxiliary Drives

Condensing and noncondensing boiler feed pump auxiliary turbine drives were examined. The exhaust loss of the main turbine can be reduced by increasing the exhaust area for a given flow. The condensing turbine drive, in effect, adds to the total exhaust area of the main turbine-generator unit and, therefore, a gain in cycle efficiency results.

Since the main turbine will be of the 3600 rpm, cross-compound, four-flow type with 26 in. last stage buckets, exhaust losses when operating between the expected 1 in. Hg and 1.5 in. Hg back pressure will not be high. Consequently, the condensing turbine drive would not improve cycle efficiency enough to offset its higher cost

TABLE 1 — PHYSICAL DESCRIPTION of boiler feed pump and driver equipment for cross-compound, four-flow, 3600/3600 turbine-generator with steam conditions of 2400 psig, 1050 F at throttle and 1000 F at reheat given below

Pump drive arrangement	Main turbine-generator shaft	Auxiliary turbine	Motor, 1800 rpm
Main unit rating:			
Turbine, kw	265,000	258,000	265,000
Generator, kva	312,000	312,000	320,000
Boiler feed pumps:	2 required	2 required	2 required
Capacity, gpm	2100	2150	2100
Total developed head, ft	6950	7000	7000
Speed, rpm	3500	6400	5400
Control	Variable speed	Variable speed	Regulating valve
Startup pump	1 required	1 required	—
Capacity, gpm	700	700	—
Total developed head, ft	7000	7050	—
Speed, rpm	3570	3570	—
Control	Regulating valve	Regulating valve	—
Percentage of maximum rated unit capacity with largest pump out of service	83	83	67
Auxiliary turbine:			
Source of steam supply	—	Cold reheat	—
Pressure and temperature	—	550 psig and 650 F	—
Exhaust of turbine to:	—	Deaerator	—
Number of uncontrolled extractions	—	2	—
Rated horsepower	—	4500	—
Rated speed, rpm	—	6400	—
Motors for boiler feed pumps:			
Horsepower	—	—	4500
Speed, rpm	—	—	1800
Voltage, volts	—	—	4160
Power source	—	—	Auxiliary power transformer
Motors for startup pump:			
Horsepower	2000	2000	
Speed, rpm	3600	3600	—
Voltage, volts	4160	4160	—
Power source	Cranking transformer	Cranking transformer.	— —



3 STEAM AND CONDENSATE CYCLE diagrammed for motor and main turbine-generator shaft drive arrangements

compared to the noncondensing turbine drive.

Pump arrangements considered with the noncondensing turbine drive were with one full-size and with two one-half-size high speed pumps. The 3600 rpm pump was not considered, as the economical turbine drive would be at a higher speed with which the higher speed pump would be more compatible.

An electric motor driven boiler feed pump is required during the startup period when steam is not available to run the auxiliary turbine. While not considered a spare, this pump could nevertheless be utilized to minimize the loss of output in the event of an emergency outage of an auxiliary turbine driven pump. Since it is expected that the startup pump would rarely be used in continuous operation, a feedwater regulating valve rather than variable speed equipment was included for flow regulation from this pump.

Loss of a full-size pump would reduce the load carrying ability of the unit to a value commensurate with the electric motor driven startup pump capacity. Since the probability of forced outages, due to loss of a full-size pump did exist, a one-half-size motor driven startup pump was included to minimize the probable forced outage cost.

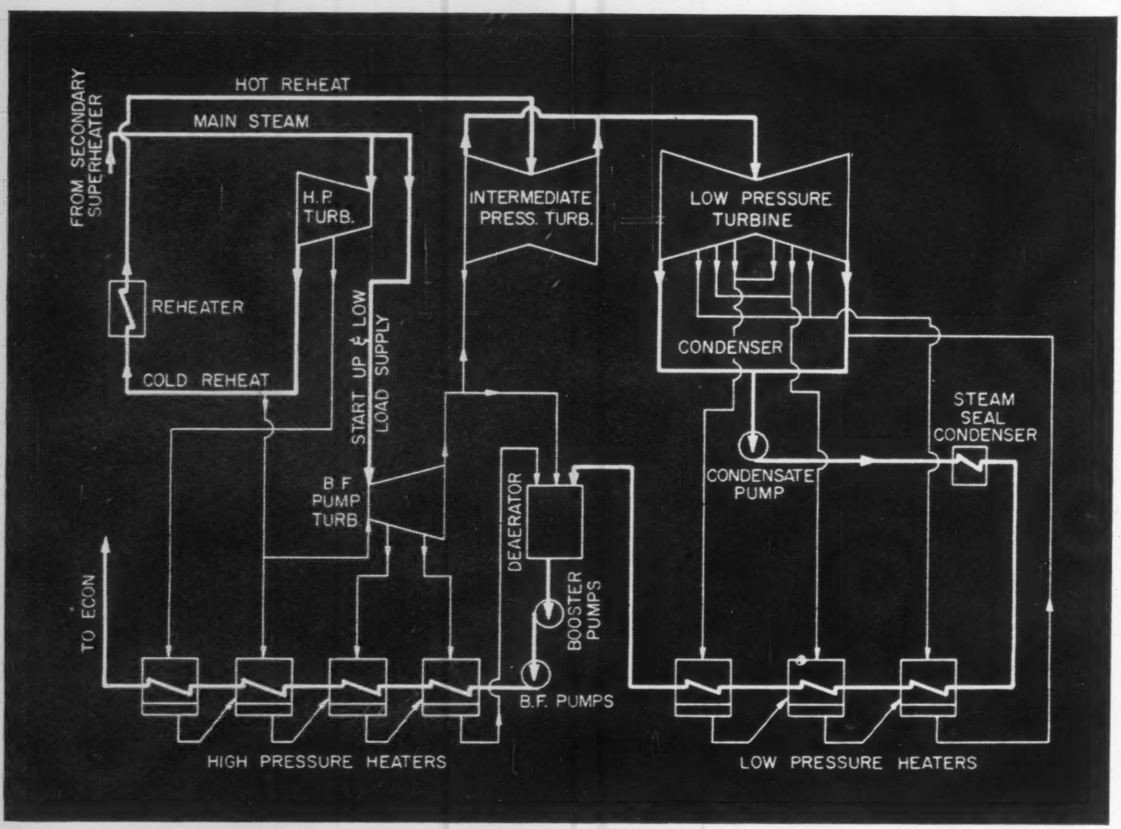
Loss of one one-half-size pump would only reduce the load to two-thirds of full load, plus the added load contributed by the electric motor driven startup pump if it is put into operation. In this instance, a one-sixth-size full pressure startup pump rather than a half-size-pump was included to minimize the investment.

The full-size and half-size auxiliary turbine driven pump arrangements proved to be very nearly the same in evaluated cost. This was due to the greater outage penalty that was applied against the full-size pump arrangement. The arrangement with two one-half-size auxiliary turbine driven boiler feed pumps was selected for further comparison with the arrangements having other methods of drive.

Check Other Drives

A total of 10 different arrangements of turbine-generator shaft drives was evolved and considered. Included were full-size and half-size pumps, constant and variable speed equipment, and 3600 rpm and higher speed pumps.

It was concluded that the most flexible and economical shaft drive arrangement would be with two one-half-size, 3600 rpm pumps, each driven through a fluid coupling. Briefly, this con-


FROM SECONDARY SUPERHEATER
HOT REHEAT
MAIN STEAM
H.P. TURB.
INTERMEDIATE PRESS. TURB.
LOW PRESSURE TURBINE
REHEATER
START UP & LOW LOAD SUPPLY
CONDENSER
COLD REHEAT
STEAM SEAL CONDENSER
CONDENSATE PUMP
B.F. PUMP TURB.
DEAERATOR
BOOSTER PUMPS
TO ECON
B.F. PUMPS
HIGH PRESSURE HEATERS
LOW PRESSURE HEATERS

4 FOR AUXILIARY TURBINE DRIVE arrangement, steam and condensate follow this cycle

clusion was based on the following considerations:

The 3600/3600 rpm cross-compound unit permitted the consideration of one full-size *vs* two half-size pumps. The half-size pumps provide an advantage of power savings compared to the full-size pump at loads under two-thirds (with one pump only in service), should the unit be operated at light loads for long periods during the night or weekends. Moreover, complete loss of load with half-size pumps is less likely. The two half-size pumps were therefore selected.

All shaft drive arrangements require means to limit the torque that could be imposed on the turbine-generator shaft in the event of pump seizure. Constant speed arrangements included a clutch with a shear coupling to limit the torque, while variable speed arrangements included a fluid coupling with its inherent slip characteristic to limit the torque. The fluid coupling has the advantage of permitting the return of the pump to service while the turbine-generator is in operation. With the clutch arrangement, the turbine-generator shaft would have to be brought to a stop to reconnect the pump after declutching.

Although the fluid coupling added substantially to the investment, its cost was very nearly offset by the cost of the clutch, feedwater regulating valve, and associated piping. Evaluation of the power requirements to drive the constant speed and the variable speed pumps showed, with the predicted capacity factors, a decided reduction in energy cost for the variable speed pump. Because of the greater flexibility and the lower comparative cost, the fluid coupling was selected for the shaft drive arrangement.

On the basis of a comparison that was made of 3600 rpm *vs* higher speed pumps, the 3600 rpm pump was selected. The lower cost of the higher speed pump and the speed increaser combination was offset by the cost of a booster pump installation needed to furnish the high NPSH requirements of the higher speed pump. It should be noted that the savings which applied in the case of electric motor driven pumps, when 1800 rpm motors could be used with high speed pumps, are not applicable with turbine-generator shaft drives.

The shaft drive arrangements with the two one-half-size pumps included a one-sixth-size full pressure startup pump. This is required during the startup period when steam is not available to run the turbine-generator and while the turbine-generator is being brought up to synchronous speed.

Make Final Comparison

The three selected boiler feed pump arrangements, each with a different method of drive, were next compared. Table 1 shows the variations in the basic specifications for the turbine-generator and for the associated pumping equipment on the basis that the net kilowatt capability of the turbine-generator would be the same with all three boiler feed pump drive arrangements. Keeping the net capabilities the same required a minimum of major power cycle equipment changes and, thus, comparison of the boiler feed pump drive arrangements was greatly facilitated.

Fig. 3 makes it clear that the heat cycle diagrams for the electric motor driven and the turbine-generator shaft driven pump arrangements are identical. However, the turbine-generator drive arrangement would permit a smaller generator and a smaller auxiliary power transformer by the amount of the pump power.

The balance of the cycle equipment, such as the turbine, condenser, steam generator, feedwater heaters, etc., would for all practical purposes have identical capacity. The turbine-generator drive arrangement requires shaft extensions, fluid couplings, a startup motor driven pump not required with the electric motor drive arrangement.

On the other hand, the motor drive arrangement requires motors, circuits, and controls which are not required by the turbine-generator drive or auxiliary turbine drive arrangements, except for the motor driven startup pump.

The heat cycle for the auxiliary turbine drive is shown in Fig. 4. Steam supply would be from the cold reheat or from the boiler with exhaust to the deaerating heater or to the main low pressure turbine crossover. The auxiliary turbine provides bleed steam for two stages of feedwater heating.

Compared to the electric motor driven pump arrangement, the auxiliary turbine drive arrangement would permit a smaller main turbine, generator, and auxiliary power transformer by the amount of boiler feed pump power. The total initial steam flow from the steam generator would increase a small amount, but the reheater steam flow would decrease; however, the total heat input would remain approximately the same.

The condenser would be the same and so would the feedwater heaters, except for moderate changes in bleed steam conditions. The added equipment would be the auxiliary turbine drives, associated steam supply and exhaust piping, and startup motor driven pump. This method of drive, as previously mentioned, would not require main boiler feed pump motors, circuits, and controls.

Table 2 shows the equipment costs, excess cost differences, and penalty cost differences of the selected drive arrangements. It is evident from the table that the main turbine-generator shaft drive arrangement is obtainable at a cost reduction of $229,500, compared to the motor driven arrangement, and at a cost reduction of $178,000, compared to the auxiliary turbine drive arrangement. It should be noted that the shaft driven variable speed pump arrangements, unlike the motor-driven variable speed pump arrangements, have no generator, transformer, nor motor losses to add to the power requirement.

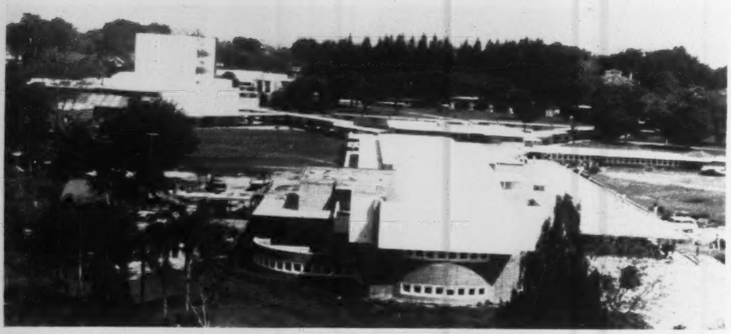
Based on the established criteria and on the prevailing prices when the study was made, the most economical boiler feed pump arrangement and drive for a 265,000 kw CC 4F turbine-generator with initial steam conditions of 2400 psig, 1050 F and 1000 F reheat is with two one-half-size 3600 rpm pumps, each driven through a variable speed coupling by the main turbine with one pump connected to the HP-LP turbine-generator shaft extension and the other pump connected to the IP-LP turbine-generator shaft extension. This arrangement includes geared driven main exciters and one one-sixth-size full pressure motor driven startup pump. ╪

TABLE 2 — ECONOMIC COMPARISON of boiler feed pump drive arrangements itemized here. Most economical arrangement of each drive type is determined from individual comparisons

Pump drive arrangement	Main turbine-generator shaft	Auxiliary turbine	Motor, 1800 rpm
Main pump size, number, speed	½, Cap. 2 @ 3600	½, Cap. 2 @ 6400	½, Cap. 2 @ 5400
Startup pump size, number, speed	1/6, Cap. 1 @ 3600	1/6, Cap. 1 @ 3600	Not required
Cost Comparison			
A) Equipment costs			
Main pumps and accessories	$159 500	$127 500	$178 000
Main pump spare assembly	34 500	28 500	28 500
Startup pump and accessories	82 500	82 500	0
Variable speed couplings	90 000	0	0
Auxiliary turbines and accessories	0	450 000	0
Motors, main pumps	0	0	290 000
Motors, startup pump	52 000	52 000	0
Turbine-generator cost difference	200 000	0	200 000
Total equipment costs	$618 500	$740 500	$696 500
B) Excess cost differences			
Building, foundations, materials and labor	$ 46 000	$ 7 000	$ 3 000
Piping, valves and controls, materials and labor	4 500	20 500	0
Accessory electric, materials and labor	14 500	0	97 000
Total excess cost differences	$ 65 000	$ 27 500	$100 000
C) Penalty differences*			
Maintenance	$ 3 500	$ 14 000	$ 500
Forced outage	0	0	5 500
Performance	0	83 000	114 000
Total penalty differences	$ 3 500	$ 97 000	$120 000
A) Total equipment costs	$618 500	$740 500	$696 500
B) Total excess cost differences	65 000	27 500	100 000
C) Total penalty differences	3 500	97 000	120 000
Total comparative cost (A+B+C)	$687 000	$865 000	$916 500

*Annual penalties capitalized at 15 percent, based on fuel cost of 40¢ per million Btu for first year and increasing at rate of 2 percent per year thereafter.

Capacity Factor: An average unit capacity factor of 0.63 for 35 year life.



SCIENCE BUILDING, most recent addition to Florida Southern College campus, houses classrooms and laboratories that are air conditioned by individual packaged units. Access doors are provided on each unit for service, maintenance

Built-in Packaged Units Solve Cooling Problems Posed by Unusual Architecture of College Campus

By P. BONEY
Air Conditioning Div.
Westinghouse Electric Corp.

THE INSTALLATION of air conditioning equipment in buildings on the campus of Florida Southern College, Lakeland, Fla., posed unusual application problems. The campus is probably the largest concentration of Frank Lloyd Wright architecture in the world. One of the requirements faced by the Engle Electric Co., air conditioning contractor for the job, was that the basic architectural design could not be altered by the addition of air conditioning equipment and ductwork.

The air conditioning installation required very close coordination between Mr. Engle and Mr. Wright, as well as Mr. Wright's representative on the campus, to comply with the late architect's principles of design. One of these principles is that all furnishings and equipment should be integral with the structure. This requirement meant that all of the air conditioning units had to be built *into* the structure and still leave proper access for servicing.

Since all of the buildings are of poured concrete and block masonry and many of the interior walls are of the block construction, ductwork became a major problem. This led to the use of packaged units that could be built into the structure and at the same time minimize the ductwork.

Some supply ducts were necessary, however, and risers were placed inside poured concrete columns. The risers were filled with sand while the columns were being poured to prevent their collapsing. Sand removal was a slow process, but this method enabled the contractor to meet the architectural requirements.

Mr. Wright believed that a shelter should enclose without confining. He also believed that the best way to light a building was without artificial lighting. Therefore, in striving for new ways to admit light, he included cantilevered roofs with glass skylights and block walls pierced for glass inserts.

This lighting technique resulted in problems of locating air conditioning equipment and ductwork throughout the campus—especially in the administration building. The equipment in this structure was placed in the basement, with ductwork run into the office area above so as not to interfere with the use of glass in the walls and ceiling.

The Polk County Science Building, latest addition to the campus, includes a citrus laboratory, chemistry laboratory, and bio-chemical research laboratory. Its classrooms and laboratories serve as good examples of the use of packaged air conditioning units being built into a structure.

Access doors have been provided to permit service and maintenance. Water valves, piping, and electrical disconnects are inside the access doors within easy reach. In some cases, return air enters the unit through a grille in the front of the unit. In others, the units are completely enclosed, with the filters located behind grilled panelling in the wall.

The science building, opened in 1953, is the 10th structure to be completed in the master design which will consist of a complex of 18 detached buildings, all of poured concrete and block masonry connected by miles of covered walks. Seven of the 10 completed buildings in this "college of tomorrow" have been air conditioned by packaged units and remote heat pumps. The total installation amounts to approximately 250 tons of cooling capacity.

Except for the heat pump installations, the buildings are heated by circulating hot water through heating coils incorporated in the air conditioning units. ‡

"Ratio Control" Systems Now Practical For Classroom Unit Ventilators

● Proportional ratio controls, previously used almost exclusively on larger heating and ventilating systems, have recently been made economically practical for application on classroom unit ventilators. According to the author, "ratio control" offers numerous benefits that add up to constant classroom temperature. This article details how these controls operate, their design criteria, and how they can be used to the best advantage.

Mr. Winston received his BS in mechanical engineering from the University of Illinois in 1951. Since his graduation he has served Barber-Colman's Automatic Controls Div. both in the factory control engineering department and in field supervision and installation of controls. He has been in charge of control application engineering for the past three years.

By JAMES R. WINSTON
Chief Application Engineer
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WHAT IS *ratio control?* Ratio control is a term applied to proportional control systems utilizing a room temperature sensing element and a discharge temperature sensing element acting together at all times to determine the final position of the controlled device(s). The relative authority of the room sensing element compared to that of the discharge element is usually given as a ratio; for example, 16 to 1 (room discharge).

Ratio control (in the form of master, submaster control systems) has been used for many years on central fan systems, but has not been economically practical for classroom unit ventilators until recently.

What are its advantages? With ratio control, the discharge sensing element has an active voice in the final position of the valve or damper operator at all times. Important benefits are derived from the use of a discharge element, some of which are:

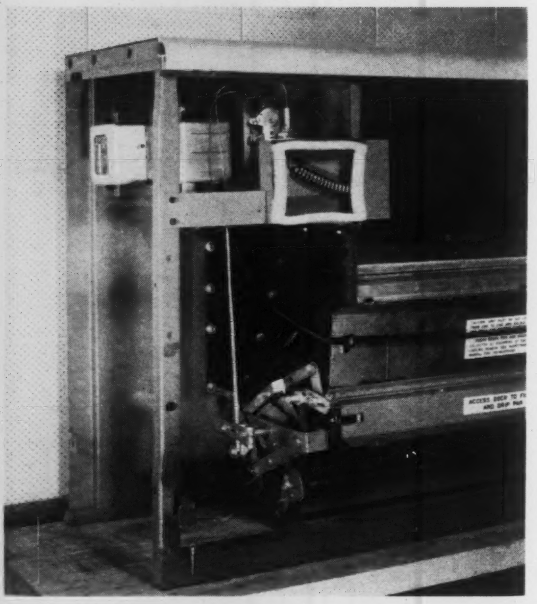
1) Elimination of drafts
2) Very accurate temperature control
3) Preservation of the natural cooling capacity of a unit ventilator
4) Savings on fuel costs
5) Simplification of control system
6) Less maintenance.

How is ratio control accomplished? Two different means are presently in general use:

1) Liquid-filled thermal sensing elements
2) Resistance sensing elements incorporated in electronic bridge circuits.

Let's analyze the liquid-filled system first. This system normally consists of a large coiled bulb for sensing room air temperature, and a smaller coiled or averaging bulb for sensing discharge air temperature. Both bulbs have large surface areas in relation to the amount of liquid fill in them for rapid heat transfer, resulting in rapid sensing of changes in temperature conditions.

Both bulbs are connected by means of capillary tubes to a common bellows assembly, which actuates the thermostat mechanism. The thermostat, in turn,



COMBINATION DUAL-ELEMENT control package shown mounted in face and bypass unit ventilator with exterior cover removed. Sampling chamber and room air sensing bulb can be seen near top of unit ventilator

Keep throttling range as low as possible to minimize

positions the control operator(s) on coil valves and/or dampers to maintain desired room and discharge temperatures.

Amount of Liquid Determines Ratio

The amount of liquid fill (fluid) contained in the room air bulb in relation to the amount contained in the discharge bulb determines the ratio (authority) of the room bulb compared to the discharge bulb. As both bulbs are connected to the same bellows, a drop in temperature at one bulb (resulting in contraction of the fluid at that bulb) will be balanced by a corresponding rise in temperature (expansion of the fluid) at the other bulb.

Liquid-filled dual element controllers are normally used for applications where sensing of the space temperature to be controlled takes place at the unit location. An aspirated room air sample is drawn over the room bulb by the unit ventilator fan, giving an accurate measurement of room air temperature at the student level.

The same temperature sensing action is also often accomplished using resistance type sensing elements incorporated in an electronic circuit which operates on the Wheatstone bridge principle. The room element is connected to one leg of the bridge, and the discharge element, in series with a fixed resistor, is connected to an opposite leg of the same bridge. The bridge output signal (voltage) is then fed to an electronic amplifier which amplifies the signal to a useful level. This signal can then be used to position the control operator(s) on coil valves and/or dampers to maintain desired room and discharge temperatures. The bridge circuit is said to be "balanced" (calling for neither heat nor cooling) when the output voltage is zero.

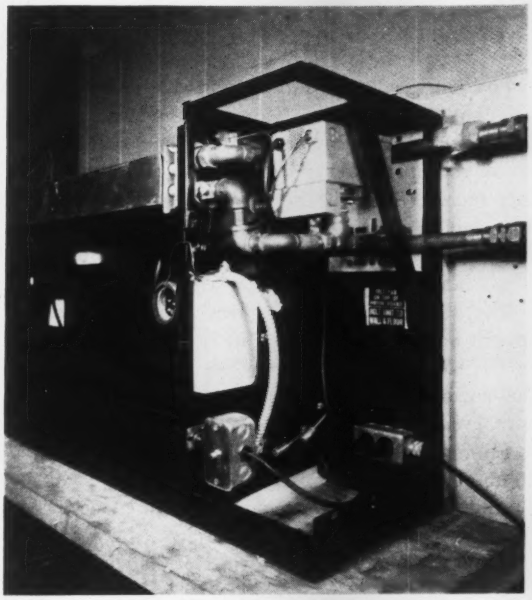
The room element resistance is normally selected as 1000 ohms at 70 F. Resistance of the discharge element is selected to obtain the desired ratio between the room and discharge elements. For example, a discharge element with a resistance of 50 ohms at 70 F in series with a fixed resistor of 950 ohms will result in a ratio of 20 to 1 between room and discharge. As the two elements are in opposite legs of the bridge, a drop in temperature at the room element will be balanced by a corresponding rise in temperature at the discharge element.

The fast response of resistance sensing elements improves their performance over bimetal or vapor-filled thermostats when wall mounted, but location of resistance sensing elements in a sampling chamber at the unit further improves control performance, and results in other benefits described later.

Feedback Stops Control Operator

What does ratio control do? To understand the control action of a system using ratio control, it is first necessary to review proportional control. In a

MOTOR-OPERATED VALVE control shown mounted in unit ventilator with exterior cover removed. Discharge air sensing element is strapped to leaving side of coil and covers as much of coil area as possible



offset, but high enough to maintain control stability

single-element proportional control system, *feedback* is employed to stop the control operator before it moves through its entire stroke on a change in temperature at the sensing thermostat. This is necessary because of the time lag between a change in position of the controlled device and a resultant change in the temperature sensed by the thermostat.

If feedback were not used, the operator would continue moving on a temperature change until it reached the end of its stroke and would never assume intermediate positions. The actual mechanics of how this feedback is obtained from operator position varies with the type of control system (pneumatic, electric, or electronic), but it is a basic fundamental requirement of any proportional control system.

The amount of operator position feedback in a control system is usually called *throttling range*. This is defined as the temperature change required at the main sensing element to cause the control operator to reposition from the full heat position to the full cooling position. The amount of throttling range required varies with the application, but again some feedback is required for control stability in all proportional control systems.

Minimize Shift in Control Point

Because operator position feedback restores the control system to balance without a corrective temperature change at the sensing element actually having to take place, a shift in control point occurs. This control point shift in a proportional control system is referred to as offset or "droop" and, again, is common to all proportional control systems, whether they be pneumatic, electric, or electronic.

It is therefore desirable to keep the throttling range of the system as low as possible to minimize offset, and yet high enough to maintain control stability and prevent operator hunting or cycling.

When a discharge element is added to a single-element room control system, the result is a dual-element ratio control system. The action of the discharge element is in the same direction as that produced by the operator position feedback mechanism. That is, the discharge element tends to cancel out the effect of the room element and to restore the system to balance, thereby anticipating the eventual effect of a discharge temperature change on room conditions. Therefore, the action of the discharge element is also proportional feedback in the control system.

There is a major difference, however, in the discharge element feedback action as compared to that obtained from operator position. Operator position feedback indicates only operator position—not the effect of that operator position. For instance, if the room element called for heat, but no heat was available, operator position feedback would still restore the system to balance as the operator moved—even though no change in heat input to the space actually took place.

Ratio control of unit ventilators keeps classroom

Position feedback anticipates what should happen, but not what does happen. Discharge element feedback, on the other hand, would allow the operator to continue moving on a call for heat until heat was sensed, or until the operator reached the full heat end of its stroke. The discharge element measures what is truly happening in a system, not just what should happen.

The discharge element offers another important benefit not available without it. It will detect changes in the supply system as they occur, and correct for these changes before they can affect room temperature, giving a more stable control system.

From the above discussion it may seem desirable to obtain 100 percent of the control system feedback from the discharge element, and eliminate operator position feedback altogether. However, this would be possible only if there were no time lag whatsoever between a change in operator position and a resultant change in discharge temperature. Actually, there is a lag due to the mass of the coil and other unit components. Also, the sensing element itself has some time lag. These time constants make it necessary to obtain part of the control system feedback from operator position and part from the discharge element to get stable control.

What Are Benefits of Ratio Control?

What are the specific benefits obtained by using ratio control? These are an important step forward in the field of temperature control, particularly as applied to classroom unit ventilators, and are as follows:

1) Complaints of drafts due to rapid changes in discharge temperatures—are eliminated.

2) Stable discharge temperatures without cycling are obtained.

3) Changes in heat input to the controlled space are anticipated—by actual sensing of both discharge temperature and operator position, rather than by operator position only, as with conventional room and low limit control systems. This insures that the exact discharge temperature required by room conditions will be delivered.

4) Variations in discharge temperature—caused by variations in outdoor or supply water temperature—are corrected by the discharge element before they can affect room conditions.

5) Overheating is eliminated, resulting in increased fuel economy.

6) Maximum cooling capacity of the unit ventilator is utilized when needed, due to stable discharge temperatures on the cooling cycle.

Let's assume an average classroom of 1000 sq ft, facing south, with 240 sq ft of window glass shaded with venetian blinds, 35 occupants, artificial lighting of 2.3 watts per sq ft, and a maximum solar gain based on a location of 45 deg north latitude on December 1. Such a classroom would have about the greatest heat gain possible, as we have taken a fully occupied condition with maximum solar gain (sun effect) and also have the lights on at the same time.

This classroom would require 1250 cfm (100 percent) of outside air at 55.3 F when the outdoor temperature is 55.3 F to maintain a room temperature of 75 F. If a 1500 cfm unit were used instead, this same classroom would require 1500 cfm of outside air at 57.8 F to maintain 75 F within the room. (Use of the 1500 cfm unit in sun-exposed rooms is desirable because of the greater need for cooling capacity.)

At outdoor temperatures less than 55.3 F with a 1250 cfm unit (or 57.8 F with a 1500 cfm unit), a higher discharge temperature is required because of increased heat losses to the outside. Above these outdoor temperatures, discharge air temperatures below outdoor temperature are not available without mechanical cooling, and the unit will not be able to offset heat gains and maintain room temperature at 75 F.

A north facing classroom will not have the solar heat gain of one facing south and so will always require a higher discharge temperature for the same outdoor conditions.

Therefore we can conclude that, if 1250 cfm per 1000 sq ft is used as the basis for sizing units in the average sun-exposed classroom, a discharge temperature below 55 F will not occur and a low limit is not required. If a 1500 cfm unit were used instead, then the lowest discharge temperature one could expect to encounter under conditions of maximum heat gain from all sources would be 57.8 F.

In either case, we must choose between accepting discharge air at these temperatures or placing a higher arbitrary limit on discharge temperature by adding a low limit. The latter would cause the room to overheat at even lower outdoor temperatures than those given above. In my opinion, it is better to accept the 55 F (or 57.8 F) discharge in those few instances when it would occur, than to overheat the classroom at these outdoor temperatures—*as long as the discharge temperature remains stable and does not cycle.*

A fluctuating discharge temperature will cause complaints of drafts. As low limits tend to cycle, they are often set higher—sometimes as high as 65 or 70 F—seriously limiting the cooling capacity of the unit ventilator and destroying its ability to furnish the needed cooling in sun-exposed classrooms.

temperatures constant—regardless of quick weather changes

Low limits were required before ratio control was available, as the lag of the room thermostat behind actual room conditions allowed "overshooting" of room and discharge temperatures. The room thermostat would finally sense the overheated room condition, and call for enough cooling to overcome this condition. A low limit discharge thermostat was a necessity to prevent discharge temperatures below 55 F as the room thermostat attempted to correct the overheated condition. The ratio control discharge eliminates all this by insuring that the correct discharge temperature is supplied at all times.

Advantages of Sampling Chambers

How should ratio control be designed to obtain maximum benefits? First, the best control system for the normal classroom will utilize a sampling chamber in the unit ventilator for the room air temperature sensing element. This is because the sampling chamber location provides the following benefits:

1) Fast response to changing conditions in the space is effected, due to positive air movement induced over the sensing element by the unit fan.

2) As students are not located on the wall 4 or 5 ft above the floor, air temperature sensed at the sampling chamber is more representative of actual room conditions at students' level than temperature sensed at a wall location. Air movement pattern in the room at the student level is toward the unit ventilator—not away from it.

3) The sensing element is not affected by the temperature of the wall.

4) Thermostats designed for sampling chamber location are not affected by dirt or dust.

5) The thermostat in the unit is tamperproof and can be adjusted only by authorized persons.

6) The location of the room element in the unit ventilator allows it to be combined with the discharge element, reducing the number of components and simplifying the control system.

7) Maintenance costs are reduced.

The only problem of the sampling chamber location occurs if a representative sample of room air cannot be obtained at the unit location. Typical examples are ceiling-hung unit ventilators, or those located in rooms other than spaces they serve. In these cases, wall mounted thermostats are to be preferred over sampling chamber control.

Cite Typical Specification

A typical guide specification for a ratio control system utilizing a unit mounted dual-element thermostat follows:

1) *General*: A complete system of (electric, electronic, or pneumatic) temperature controls shall be furnished for each classroom unit ventilator. All thermostatic control equipment shall be located within the unit ventilator enclosure. Both room and discharge air temperatures shall be controlled at all times during occupied periods by means of the ratio controller. Discharge air temperature shall be sensed by an element located in the leaving airstream. Stable control of discharge temperature without cycling shall be maintained at all times on both heating and cooling cycles. The unit air discharge temperature shall not be allowed to fall below 55 F. A means of adjusting room temperature control point shall be accessible to authorized persons only.

2) *Ratio controller*: The room and discharge air controller shall be of the ratio type which resets discharge air temperature in accordance with room requirements. The ratio (change in discharge temperature caused by a 1 F change in room temperature) shall fall between 12 to 1 and 20 to 1. The ratio furnished shall be suitable for the application as determined by the control manufacturer, but shall be adjustable within ± 15 percent from the nominal value, after installation, to compensate for on-the-job conditions. The room air sensing element shall be suitable for location in a sampling chamber. The discharge sensing element shall be of the averaging type with a minimum length of 24 in. The room control point adjustment dial shall be suitable for mounting beneath a hinged access panel to be provided by the unit ventilator manufacturer. (The hinged access panel, of a type which can be locked, should be specified.)

3) *Sampling chamber*: An aspirated sampling chamber suitable for a room temperature sensing element shall be furnished by the unit ventilator manufacturer. The room air inlet to the sampling chamber shall be through the front panel of the unit ventilator at least 14 in. above floor level. An air-tight seal between the front panel and the sampling chamber, which does not interfere with removal of the front panel, shall be provided. The sampling chamber itself shall be sealed against leaks so that air from within the unit ventilator enclosure cannot infiltrate. The sampling chamber shall be suitably insulated against effects of ambient temperatures within the unit ventilator enclosure. The sampling chamber shall be arranged to draw a minimum of 8 cfm of room air over the entire sensing element.

In addition to the above, the complete control specification must also include (1) the desired cycle of operation for the classroom unit ventilators and (2) control specifications for outdoor reset of supply water temperature on all hot water systems. ±

the law and your profits

JOHN F. MORRISSEY, author of this regular feature, is an attorney at law and has an extensive practical business and legal background. This series is based on actual cases. All names are, however, fictitious. It should, of course, be remembered that the law varies in different states.

Clearly Define All Words and Phrases When Drawing Up Contract Agreements

These contractors didn't — and ended up in court

IT IS NOT uncommon for two parties to a contract to discover that each attributes a different meaning to some word or phrase of the agreement. Unfortunately, the discovery usually comes too late to avoid difficulties. The following case demonstrates how a seemingly simple phrase is often not so simple.

I. N. Clement Co., a general contractor, entered into a contract to construct a suburban store. E. Quivocal Co. subcontracted to install the heating plant. The subcontract incorporated the terms, plans, and specifications of the general contract which contained a provision that the store would be completed "within 140 working days, Sundays and holidays excepted."

Work began on October 10. Because of severe cold there were many days on which work was suspended on the order of the architect. On April 10, Clement Co. requested Quivocal to proceed to install the heating plant. Quivocal refused, on the ground that more than 140 working days had elapsed and that the costs of labor and material had increased during that period. Clement brought Quivocal into court for breach of contract.

"There were only 78 days," argued Clement, "on which work was done prior to the request to Quivocal to install the plant. Quivocal could have completed his work in about 30 to 40 days, well under the 140 working days referred to in the contract. Work interruptions because of cold weather should not be computed in the number of working days."

"You're wrong," said Clement. "Working days are all the days except Sundays and holidays."

The trial court agreed with Quivocal and construed the time limit to mean 140 days excepting only Sundays and holidays. Quivocal was found not guilty of breach of contract and Clement appealed to a higher court.

"The contract does not say 140 days," stated the higher court, "it says 140 working days. Following the well-established rule which requires every word in a document to be given a reasonable interpretation if possible, we must give meaning to the word 'working.' A natural reading suggests that it was intended to describe 'working days' as distinguished from 'nonworking days'."

"The work was begun in October," continued the higher court, "and construction was contemplated during the winter. It was only reasonable to expect work to be stopped in cold weather."

The higher court sent the case back to the trial court for a new trial with instructions that there should be deducted from the 140 days, not only Sundays and holidays, but such days when work was reasonably suspended because of cold weather.

Under this ruling, Quivocal eventually lost the case and was required to pay damages to Clement.

Words and phrases susceptible to various interpretations should certainly be defined in drawing up contracts. One can never take for granted that the other fellow has a similar understanding. We probably all have used the phrase "working days" both in Clement's meaning and in Quivocal's. ╪

Nomograph Is Shortcut to Finding Exhaust Hood Air Flow Rates

By CLYDE F. METZLER
Chief Engineer
National Technical and Scientific Co.

HOW MUCH AIR will pass through an exhaust hood of a given duct area, entry coefficient, and static pressure? The nomograph on the next page permits quick computation of the air flow rate through any type of exhaust hood.

This nomograph is based on the equation:

$$F = 4000\ AC\sqrt{P}$$

where:

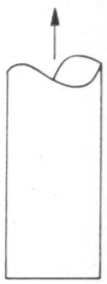
F = air flow rate through hood, cfm
A = hood duct area, sq ft
C = entry coefficient, expressed as a decimal
P = static pressure across hood, in. water gage.

As you will see from the following example, the nomograph saves considerable time in making these calculations.

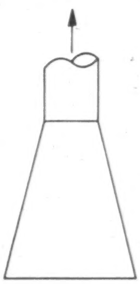
Problem: What is the air flow rate through an exhaust hood connected to a duct having an area of 0.5 sq ft if the static pressure is 2 in. WG and the entry coefficient is 0.70?

Solution: Enter the chart at the duct area of 0.5 sq ft and draw a straight line (1) through the static pressure of 2 in. WG at the right. From the intersection with the pivot, draw a straight line (2) through the entry coefficient of 0.70 at the right. At the intersection with the air flow scale, read the flow through the hood as 2000 cfm.

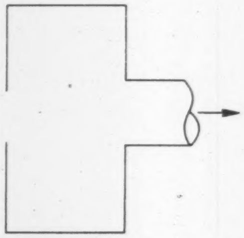
ENTRY COEFFICIENTS will vary according to hood design. Coefficients given for four most common types shown below are average values based upon experience. For specific applications where greater accuracy is desired, see section on orifices and nozzles in *Fan Engineering*, by R. D.Madison, published by Buffalo Forge Co.



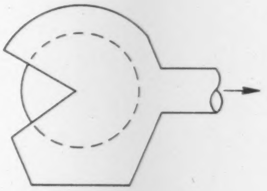
Plain pipe
C = 0.70



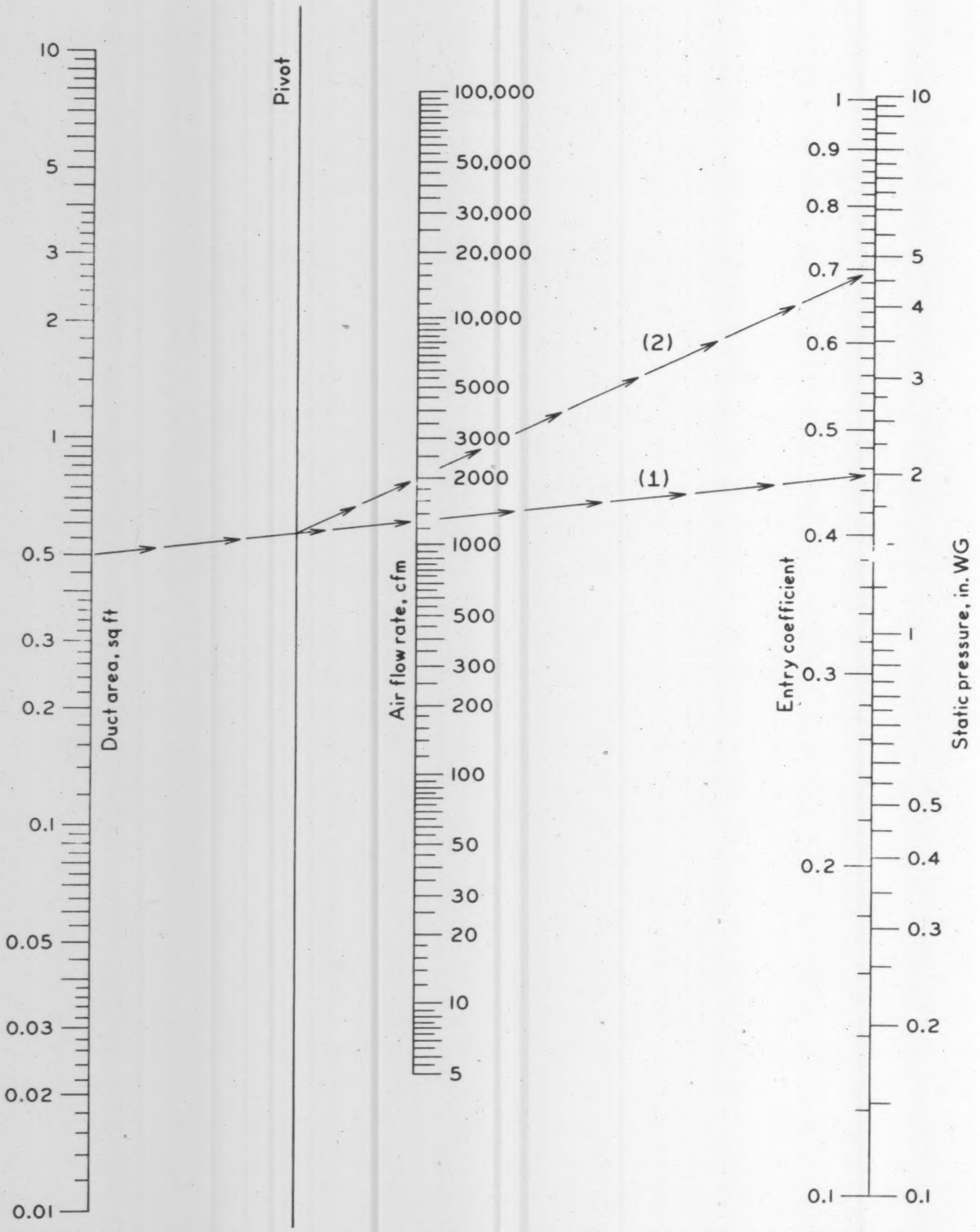
Tapered hood
C = 0.90



Sharp edge
C = 0.60



Grinding wheel
C = 0.80



IF YOU KNOW duct area, entry coefficient, static pressure for any exhaust hood, you can immediately find air flow rate by using above nomograph. See preceding page. Lines (1) and (2) plot example given in explanation

How to Operate Induction Unit Systems When Changeover Point Is Subfreezing

Last month the author described a modified system which boosts the efficiency of induction unit air conditioning systems in mild weather. Usually, the minimum quantity of primary air permitted to be supplied to the space, either by local ventilation codes or by good engineering practice, will be sufficient with the modified system operation. However, after the building design is established, Fig. 1 and Table 1 presented in this article can be used to determine quickly the minimum quantity of primary air which should be supplied to the space for proper operation of the modified induction unit system. The water contents of the system which will be affected by changeover from conventional to modified operation and vice versa will be very small. Therefore it will be possible to change over the operation of the system almost instantly.

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BECAUSE of the steady increase in the use of glass in big buildings and the consequent high solar heat loads, plus the trend toward greater office lighting loads, the induction unit system offers many apparent advantages for air conditioning this type of structure. These advantages and how the system operates were discussed in my article last month. In this article, some additional suggestions are given for proper operation of these systems when the changeover point is subfreezing.

For a refrigerating machine to function properly it will be necessary that:

1) There is sufficient cooling load on the machine to prevent it from cycling *on* and *off*

2) There is adequate means of removing the heat rejected in the condenser.

Cooling load on the machine: during the modified operating period the primary warm air will compensate for the transmission loss through the space, which is a function of outdoor temperature. Therefore the cooling requirements for the perimeter sections served by the induction units will depend upon the instantaneous internal cooling load caused by the sun, lighting, people, etc., and will be independent of the outside temperature.

The centrifugal refrigerating machines now available will function properly at partial loads of as low as 10 to 15 percent of full load. The lighting load in the space alone would impose a sufficient cooling load to keep such a machine from cycling. In a multiple machine installation, of course, some of the machines may be shut down depending upon the partial load.

Condenser heat removal: Since the system will usually be on summer cycle, the primary air temperature at any time will be governed by the nature of construction of the building, the quantity of primary air supplied to the space, and the instantaneous outdoor air temperature. When the outdoor air temperature is below 40 F the primary air temperature required in a usual application will be above 90 F. Therefore, since the water entering the cooling coils in the air handling unit will be at 105 F, no throttling type control will be necessary. The primary air temperature leaving the cooling coil will depend on the heat rejected in the condenser at a given instant. The supplementary reheat, if required for the primary air, will be provided by the conventional reheat coils in the air handling unit.

In much of the United States, cooling coils at least eight rows deep are required to properly dehumidify the primary air. The average face velocity of air used for selecting the coils is approximately 500 fpm. The following equation shows the performance characteristics of a typical finned tube coil:

Total heat rejected from the coil, Btu per hr = face area of the coil, sq ft × number of rows × mean temperature difference, F × heat transfer factor ....[1]

Because the cooling coil will act as a heating coil during the modified operating period, the sensible heat factor will be unity. For a coil with eight fins per in., a face velocity of 500 fpm, and water velocity of 4 to 8 fps, the heat transfer factor will be about 175 Btu per hr per sq ft of face area per row per F mean temperature difference. Substituting, in Equation 1:

Heat gain by air, Btu per hr per sq ft coil face area = 8 × mean temperature difference × 175 = 1400 × mean temperature difference ....[2]

Since the coil face velocity is 500 fpm, the heat gain by the air per sq ft of coil area will be:

$$500 \times 1.08 \times (t_a - 40) = 540\ (t_a - 40) \quad ....[3]$$

where:

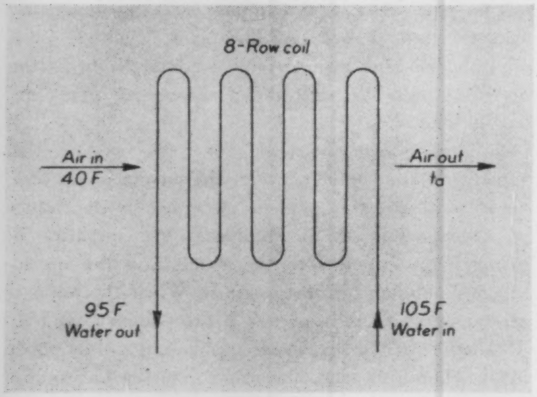
t_a = temperature of air leaving the coil, F
40 = mixed air temperature (mixture of outdoor air and recirculating air), F, entering the coil.

During the modified period of operation, the mixed air temperature in conventional induction unit systems will be controlled at about 40 F to limit the moisture content of the primary air supplied to the space.

Combining Equations 2 and 3:

$$540\ (t_a - 40) = 1400 \times \text{mean temperature difference} \quad [4]$$

Since t_a and the mean temperature difference are interdependent on each other, Equation 4 will have to be solved by trial and error. Note the conditions in the sketch below:



It is apparent that the primary air temperature leaving the coil could not possibly exceed much more than 100 F because the entering water temperature to the coil itself will be only 105 F. Therefore, the maximum heat gain by the air will be (from Equation 3) 540 (100 − 40) = 32,400 Btu per hr per sq ft coil area.

This heat transfer from the coil is comparable to its capacity under summer design conditions. Since the cooling coils are generally sized for a 10 to 12 F rise in chilled water temperature, it may be assumed that, during the modified operating period when the coil will be used for heating, the drop in the water temperature through the coil will be about 10 F at a particular instant when maximum heat transfer is required from the coil.

Even if the water temperature drop through the coil were somewhat different, say 2 to 3 F, the total heat transfer to the air would not significantly change because the mean temperature difference would hardly be effected. If at any time the heat transfer capacity of the coil is greater than the instantaneous heat rejected in the condenser, valve *G* will throttle the flow of water. At such times, of course, the drop in water temperature would increase accordingly to reduce the coil heating capacity.

Using the temperature relationship shown in the above sketch, it is found that the primary air temperature, t_a, leaving the coil will be 98 F.

From Equation 3, the heat gain by the air per square foot of coil will be 540 (98 − 40) = 31,300 Btu per hr. Since the coil face velocity will be 500 fpm, the heat gain by the air will be 31,300/500 = 62.6 Btu per hr per cfm of primary air. Or, it can be inferred that the primary air system will be capable of removing the heat rejected in the condenser at the maximum of 62.6 Btu per hr per cfm of the primary air.

Assuming the coefficient of performance of the refrigerating machine to be 4 when calculated on the cooling cycle, the heat rejected in the condenser will be 15,000 Btu per hr per ton of refrigeration. Therefore the maximum internal cooling load in the space which can be compensated for will be (62.6 × 12,000)/15,000 = 50.0 Btu per hr per cfm of primary air.

The internal cooling load, in Btu per hr per cfm of primary air, referred to here is the arithmetic average for the entire induction unit system. It should not be confused with the maximum internal cooling load per cfm of primary air for any particular zone.

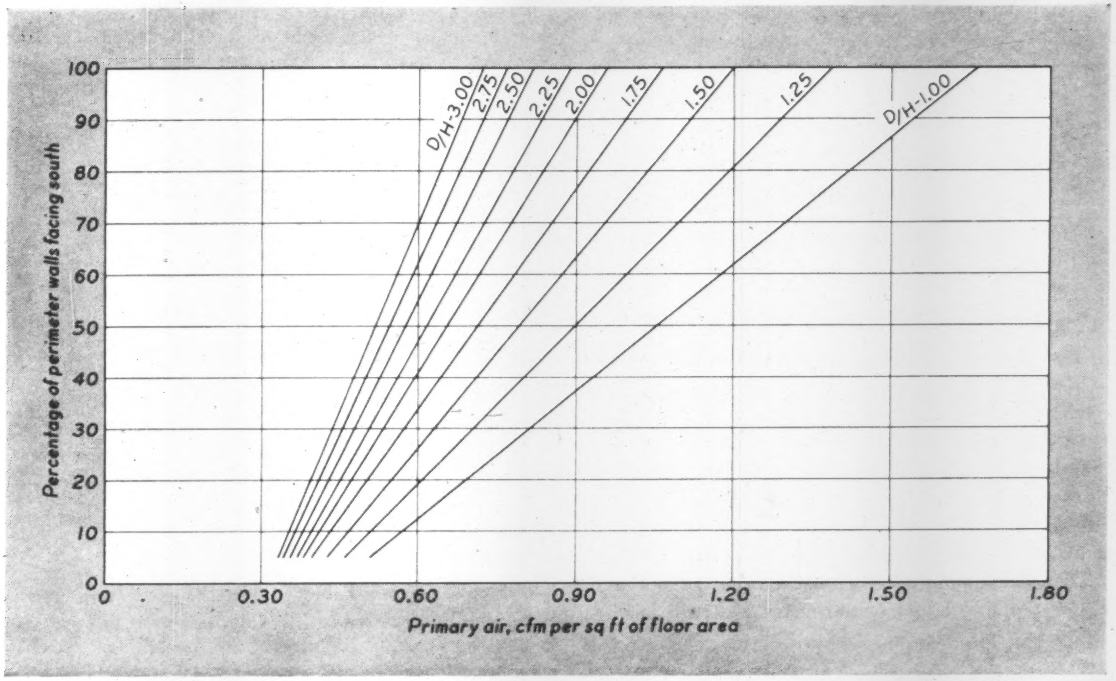
Hence, the modified system will function properly as long as the total internal cooling load in the perimeter sections of the building (solar, lighting, people, etc.) does not exceed (50 × total primary air supplied to the space) Btu per hr.

In practically all systems using single-coil induction units it will be found that, during the modified operating period, the combined internal cooling load in the space will not exceed an average of 50 Btu per hr per cfm of primary air. Consequently, the modified system will be quite practical. However, double-coil induction units are now available which provide much greater secondary cooling capacity. These units are used in an effort to reduce the total quantity of primary air to be supplied to the space. This results in savings in ductwork as well as in building space required for mechanical equipment. But, since the reduction in the primary air also results in lowering the changeover point, the use of high capacity units becomes impractical in many applications.

In modified systems, the low changeover point is not a problem. The primary air quantity can be reduced to its minimum, depending on the local ventilation codes and the maximum capacity available from an induction unit. The following simplified method can be used to quickly determine the minimum primary air required for any particular building:

In an induction unit system it is necessary to supply more or less the same quantity of primary air to each area regardless of orientation unless the building is extensively zoned. Otherwise, under certain operating conditions, it will not be possible to maintain the design conditions in all the different spaces.

In much of the United States the modified induc-



1 MINIMUM QUANTITIES of air that are required for south-facing building orientations are plotted above. *D* is depth (ft) of interior space conditioned by induction units; *H* is height (ft) of glass panes

tion unit system will be operated from September to March. During this period, due to lower angle of incidence of the sun, the solar load through the glass facing south will be much greater at noon than the solar load through the glass on the other exposures at their respective peak load condition. Therefore the internal cooling load in the building will be greatest during this period if the largest section of the perimeter walls faces south.

In the second worst application, the largest section of the perimeter walls would face either east or west. Since the difference in solar load through the glass on the south, east, and west exposures from September to March will not be much at their respective peak load conditions, it will be sufficient to tabulate data for one exposure only. The south will be the obvious choice.

Therefore, to find the minimum quantity of primary air required for any building, first determine the greatest section of the building which faces either the south, east, or west. Then, by assuming the largest of these three sections to be facing south, solve for the primary air required. This can be further clarified by stating that if a certain quantity of primary air is sufficient for a building with the largest section of its perimeter walls facing south, then the same quantity of primary air will be sufficient for another building with similar construction, but with the same percent of its perimeter walls facing either the west or the east exposure. Since the solar load through the glass facing north would be relatively negligible, it will not dictate the primary air requirements in the space.

How to Determine Solar Load

The solar load through the glass facing south will be at its maximum during the months of October and November. To make the graphical solution it will be necessary to know the solar load through the glass on the south side at its peak condition and solar load through the glass on the other exposures at the same time. This can be determined by using either the ASHRAE Guide or the *Sun Angle Calculator* devised by Libbey-Owens-Ford Glass Co.

The following assumptions are made for purposes of illustration:

1) The building will be located in a semi-industrial area, around 40 deg north latitude.

2) Shades will be drawn to prevent direct sun rays from entering the space. The shade factor will be about 45 percent.

3) Perimeter walls will be comprised of single plate glass and insulated panels. The solar load through the insulated panels will be negligible in comparison to the load through the glass, so its effect will be neglected.

4) The building will be multi-story, so the solar load through the roof will have negligible effect on the entire air conditioning system. (For a one- or

two-story building, the solar load through the roof should be added to the internal cooling load in the space for the analysis.)

5) Occupancy in the perimeter sections will be assumed to be one person per 100 sq ft of floor area.

Let:

PA = primary air supplied to the space, cfm per sq ft of floor area
D = depth of the interior space conditioned by the induction units, ft
L = lighting load in the space, watts per sq ft of floor area
H = height of the glass panes used in the perimeter wall construction, ft
X = fraction of the building's perimeter walls facing south.

By using the *Sun Angle Calculator* it is found that in October or November the solar load through the glass facing south will be about 71 Btu per hr per sq ft of glass area. Simultaneously, the solar load through the glass facing north, east and west will be about 10 Btu per hr per sq ft of glass area.

The total cooling effect available from the modified system per lineal foot of perimeter wall will be:

$$D \times 1 \times PA \times 50 \text{ Btu per hr} \quad \text{[5]}$$

The internal cooling load in the space will be:

Btu per hr = lighting load + occupancy load + solar load for south walls + solar load for north, east, and west walls.

Or:

$$\text{Btu per hr} = (D \times 1 \times L \times 3.42) + [(D \times 1/100) \times 200] + (71 \times H \times X) + 10\,(1 - X)\,H \quad \text{[6]}$$

Since, under the worst circumstances, the total cooling effect available will be equal to the total internal cooling load in the space, or by solving Equations 5 and 6:

$$X = [D\,(50PA - 3.42\,L - 2) - 10\,H]/61H$$

If the fraction X is expressed in percentage of perimeter walls, then it will be equal to:

$$X = (D/H)\,(82PA - 5.67\,L - 3.28) - 16.4 \quad \text{[7]}$$

Equation 7 is plotted in Fig. 1 for the lighting load in the space of 3 watts per sq ft of floor area. For other lighting load criteria, use the correction factor given in Table 1.

Find Minimum Primary Air Quantity

The following examples will illustrate the systematic procedure for determining the minimum quantity of primary air that will be required for a building:

Example 1: A multi-story building is to be located in the semi-industrial area of Chicago (approximately 40 deg north latitude). Depth of the space to be conditioned by the induction units = 12 ft. Height of glass panes to be used for the perimeter walls = 6 ft. Percentage of the perimeter walls to face north, 40 percent; south, 40 percent; east, 10 percent; west, 10 percent. Find the minimum quantity of primary air required per square foot of perimeter section of the building for the modified induction unit system.

TABLE 1 — CORRECTION FACTORS for ratio of depth of interior space air conditioned (D) to height of glass panes used in perimeter wall construction given below for several lighting loads. Add correction factor to given percentage of perimeter walls of building facing south. Use adjusted value obtained in Fig. 1 to determine minimum quantity of primary air required for building

Lighting load, watts per sq ft	D/H Ratio 1.00	1.50	2.00	2.25	2.50	2.75	3.00
3	—	—	—	—	—	—	—
4	5.6	8.4	11.2	12.6	14.0	15.4	16.8
5	11.8	16.8	22.4	25.2	28.0	30.8	33.6
6	16.8	25.2	33.6	37.8	42.0	46.2	50.4

Solution:

Step 1: Ratio $D/H = 12/6 = 2.00$.

Step 2: From Table 1, find the correction factor for the lighting load of 4 watts per sq ft to be 11.20 percent.

Step 3: Add this correction factor to the given percentage of walls facing south, or 40 + 11.20 = 51.20 percent

Step 4: From Fig. 1, at percentage of walls facing south of 51.20 percent and D/H ratio of 2.00, the minimum primary air required will be 0.66 cfm per sq ft of floor area.

Example 2: Same as Example 1, except the glass height is to be 4 ft. Then, in Step 1, $D/H = 12/4 = 3$. Step 2 correction factor = 16.80 percent. Step 3 adjusted percentage of walls facing south will be 40 + 16.80 = 58.80 percent. Step 4, minimum quantity of primary air required will be 0.55 cfm per sq ft floor area.

Example 3. Same as Example 1, except that the percentage of perimeter walls to face north is 15 percent; south, 15 percent; east, 35 percent; and west, 35 percent. Steps 1 and 2 are the same as in Example 1.

Step 3: Since the greatest portion of perimeter walls will face east and west, solve the example as if the largest (35 percent) were to face south. Therefore, by adding the correction factor, the adjusted percent of walls facing south will be 35 + 11.20 = 46.20 percent

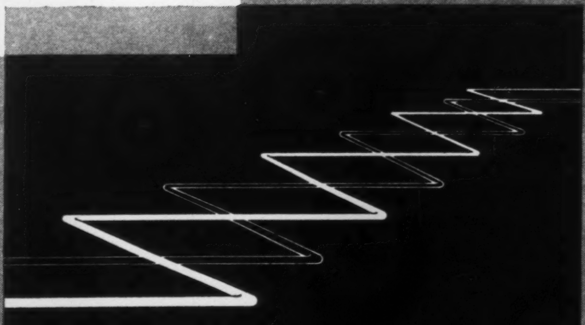
Step 4: From Fig. 1, at percentage of walls facing south of 46.20 percent and D/H ratio of 2.00, the minimum primary air required will be 0.63 cfm per sq ft floor area.

In other words, the minimum primary air required for this building will be the same, whether the largest percentage of perimeter walls in this example (35 percent) were to face the south, the east, or the west exposure. ⌗

HPAC ENGINEERING DATA FILE

How to Select and Control High Temperature Hot Water End Use Heat Exchangers

- *Effect of temperature drop*
- *Types of heat consumers used*
- *Selection of control valves*
- *Controlling the heat consumers*
- *HTHW boiler controls*



Once generated and delivered to the point of use, HTHW is put to work in many types of heat exchangers for comfort and process heating, and for steam generation. In the January HPAC Engineering Data File, considerations in designing the components to generate and deliver the HTHW were presented. In this report, we consider the end use heat exchange equipment, and the way in which the system and the various components are controlled.

To compile this report from designer's experience, the same consulting engineers who contributed to the January report were called upon to provide the information contained herein from their extensive experience with HTHW system design. These engineers include:

J. S. Blossom and P. H. Ziel, Ziel-Blossom and Associates, consulting engineers

W. T. O'Reilly, Seelye, Stevenson, Value and Knecht, consulting engineers

D. T. Robbins, Holmes and Narver, Inc., engineers and constructors

B. L. Sturdevant, Stanley Engineering Co., consulting engineers

The editors are indebted to them for their cooperation in the preparation of this report. Each has reviewed the report and has contributed specific information as noted in the list of references.

Design and Control of High Temperature Hot Water Heat Consumers

THE WAY that HTHW is put to work for comfort and process heating, and how it's controlled in various services are presented in this report. In the January HPAC Engineering Data File, the reasons for using high temperature hot water, and the methods employed for generating it and delivering it to the point of use were considered.

For the purpose of review, it should be noted that HTHW has the capability of transporting large quantities of energy over long distances in economical piping systems. The economies in distribution are directly related to the utilization of large temperature drops at the heat consuming device. That is, the higher heat losses from the distribution piping due to the higher temperature of the circulating water cannot be justified if a conventional 20 F drop is taken at the consumer.

The economic advantages of small pipe sizes and low pumping requirements depend upon extracting a much higher quantity of energy per given volume of water. The relationship of temperature drop[1] and the economic factors of pumping and piping is given in Table 1. The tabulated information indicates the gains that accrue from higher supply temperatures and correspondingly higher temperature drops. It will be noted that at the highest supply temperature, the saturation pressure — that required to prevent flashing of the superheated water to steam — is such that heavier valves, fittings, and pipe are required. The added cost of these offset in part the economic gains due to higher supply temperatures so another factor — the distance the energy must be transported — becomes important in selecting the economical temperature drop, and thus, the optimum design temperature. In general, one can conclude that when the HTHW must be transported over great distances, the higher supply temperatures can be justified. For short distribution systems, the lower values of supply temperature — 300 to 400

TABLE 1 — TEMPERATURE DIFFERENTIALS influence selection of pumps and pipe sizes for HTHW systems as indicated in data listed here for an assumed pump head and pipe friction loss

Temperature difference, F	20	50	100	150	200
Supply temperature, F	270	300	350	400	450
Saturation pressure, psig	27	52	120	232	408
Return temperature, F	250	250	250	250	250
Mean temperature, F	260	275	300	325	350
Flow rate per 20 million Btu per hr, lb per hr	1,000,000	400,000	200,000	133,000	100,000
Density of returning water, lb per gal	7.86	—	—	—	—
Pump capacity, gpm	2,125	850	425	283	212.5
Assumed pump head, ft	100	—	—	—	—
Pump horsepower required, hp	84.0	33.6	16.8	11.2	8.4
Pump efficiency, percent	60	—	—	—	—
Pipe size (head loss = 3′/100′) I.P.S., in.	8	6	5	4	3½

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[1] *Numerals refer to references listed on page 182.*

F — may provide the most economical distribution system. However, in the latter case the temperature is often decided by the steam generators connected to the system.

The characteristics of the end use heat exchange equipment or the heat consumers are also important in the choice of a design supply temperature. A typical district system will serve a wide variety of heating loads. Each of these will vary some in their design requirements and must be considered in the selection of the supply temperature. The energy consumers must be designed to utilize the large temperature drops available.

End Use Heat Exchange Equipment

High temperature hot water can be used directly for comfort heating in air heating coils, radiant heating panels, tubular radiant units, unit heaters, etc., or it can be used indirectly through generation of steam or low temperature hot water (LTHW) which is delivered to the space heating units. Likewise, for process heating it may be used directly or through a converter to produce steam. A representative group of heat exchange devices that may be found in HTHW systems are illustrated in Fig. 1.

In most district systems for comfort heating, high temperature hot water has been used principally as a primary heating medium to generate steam or LTHW at the point of use. This is in keeping with the philosophy held by many designers that it is primarily an economical means of transporting energy over great distances. It is also a function of the cost of controlling the flow to the various zones in the heated space due to high quality required in the valves used to control HTHW as will be seen in a later section.

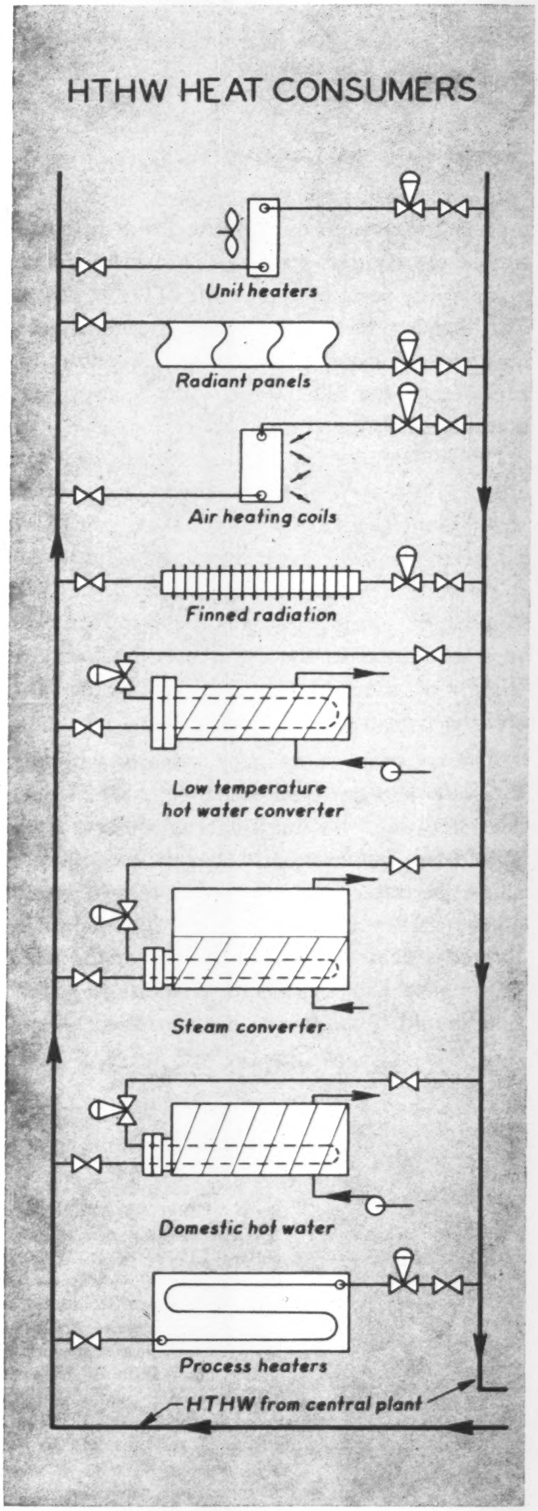
HTHW is used directly for space heating in many industrial installations through the use of air heating coils, unit heaters, etc., and in a limited way at present in offices, schools, hospitals, etc., in radiant heating elements and conventional finned radiation. Reduction in the amount of heat transfer surface and the desirability of employing radiant heating in today's typical commercial space having large amounts of glass in the exposed wall are among the reasons given for using HTHW directly. The higher panel temperatures obtainable with HTHW permit better distribution of the radiant energy with greater comfort resulting. All of the heat consumers must, of course, be designed and constructed for the pressures and temperatures encountered and should be capable of using the available temperature drop.

What to Include in Service Entrance

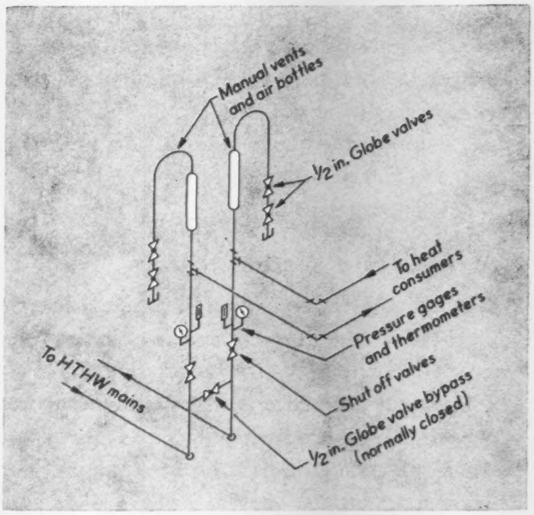
The components of a typical[2] service entrance or branch takeoff from the district main are shown in Fig. 2. Shutoff valves in the supply and return, and provision for venting are necessary. Various arrangements are used for manual venting; the one illustrated consists of an air bottle with minimum dimensions of 1-½ in. diameter and 12 in. length. The bottle discharges through a ½ in. pipe with one or two globe valves and a capped or plugged end. The second valve is a seal valve and the plugged or capped end is considered a suitable substitute. One of the vent valves should be located close to the air bottle to facilitate repair of the vent line in the event it is damaged. Automatic air eliminators are never used in HTHW piping systems.

The bypass valve and instrumentation can be considered optional though in many district systems they are desirable. The bypass is normally closed. Its function is to warm up the line initially and to keep the line warm during long shutdown periods, if it is desired to do so for protection. The bypass can also be cracked to maintain hot water at the service entrance when usage is intermittent with long shutdown periods. The instrumentation provides useful general operating information.

The bypass valve should be of the globe pattern as it will be used for throttling service. The shutoff valves may be gates or globes. Some designers prefer to use all globe valves for reasons of tight shutoff. However, others use gates suc-


HTHW HEAT CONSUMERS
Unit heaters
Radiant panels
Air heating coils
Finned radiation
Low temperature hot water converter
Steam converter
Domestic hot water
Process heaters
HTHW from central plant

1 HEAT EXCHANGERS employed in typical high temperature hot water system illustrated here indicate flexibility of system in meeting a wide variety of heating requirements


Manual vents and air bottles
1/2 in. Globe valves
To heat consumers
Pressure gages and thermometers
Shut off valves
1/2 in. Globe valve bypass (normally closed)
To HTHW mains

2 BUILDING SERVICE ENTRANCE for taking HTHW from district main should include shutoff valves, and provision for venting. Bypass is not needed but may be desirable to warm up line and to keep hot water at intermittent users. Instrumentation provides useful operating data. If the vent line from the air bottle is long, one of the vent valves should be located close to the bottle to avoid shut down in the event of damage to the vent line

cessfully and point to the lower pressure drops of the gate valves as an advantage.

Water-to-Water Converter Design

In the district heating system, water-to-water heat exchangers are employed to generate secondary LTHW or medium temperature hot water (MTHW) (See Fig. 3). The heat exchanger is constructed[2,3,4] with a welded steel shell and a removable hairpin or bent tube type tube bundle. The HTHW should flow in the tubes and the heated water in the shell. The water box construction should facilitate tube bundle removal by breaking a minimum number of piping connections. The exchanger, of course, must be made in accord with the ASME code for unfired pressure vessels for the maximum working pressures and temperatures expected in each component. For economical heat transfer, the heat exchanger should be designed so the leaving HTHW is 10 to 15 F above the leaving temperature of the secondary low temperature hot water.

The tubes can be made of several alloys. Red brass, steel, stainless steel, and cupro-nickel (90/10), for example are suitable materials. However, the choice of tube material for a given job will depend upon the temperature of the system. Most designers prefer cupro-nickel (90/10) because of its excellent resistance to corrosion and strength at elevated temperatures.

Domestic Hot Water Heaters

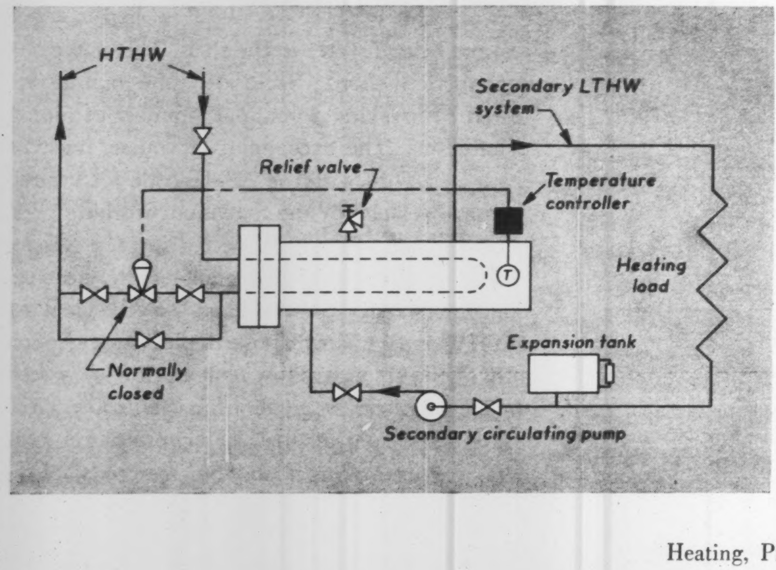
When domestic hot water is heated directly with HTHW, the heat exchanger is in most respects similar to that for generating LTHW. The principal difference is that the domestic hot water storage tank normally has a larger capacity than the shell side of a heat exchanger. The hairpin tube bundle carrying HTHW is submerged in the storage tank. The storage capacity of the heater influences the selection of the control system[2] as the control problem is not as critical as that of the shell and coil heat exchanger which will be seen in a later section. The layout for domestic water heating would be comparable with that for the water-to-water heat exchanger.

It should be noted that some designers[2] prefer to heat domestic hot water with secondary LTHW from the building supply. This preference is based on elimination of the high quality control valve required for HTHW and added safety in the event of control valve failure. However, this recommendation is tempered by the water heating load, and where the load is large, HTHW is used directly to minimize the heat transfer surface required.

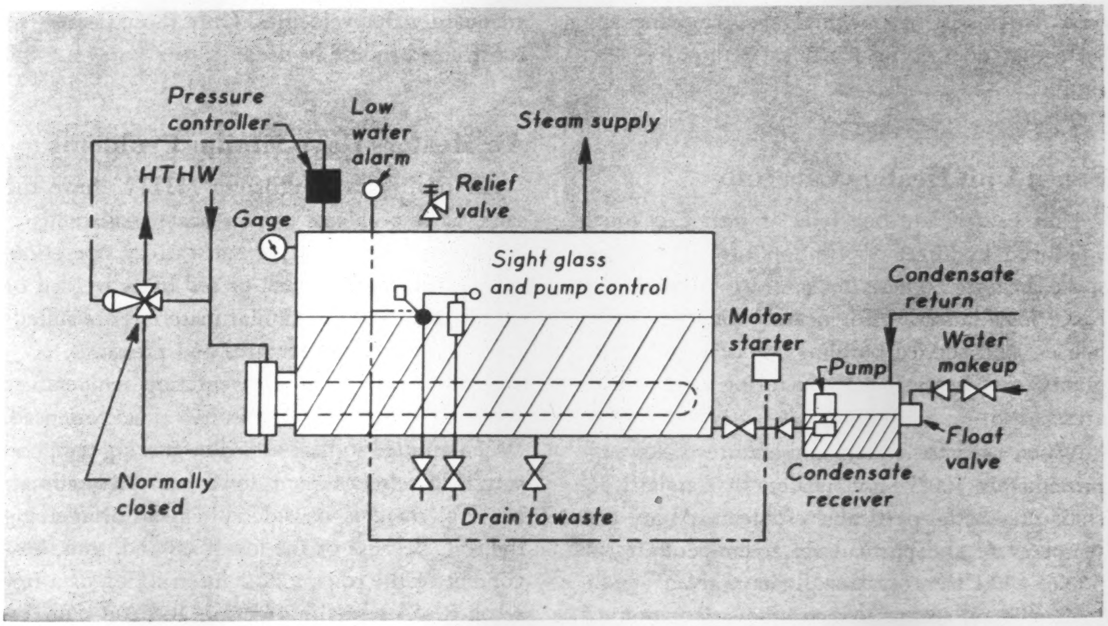
Steam Boilers (Converters)

In practically any system, some heating or process applications exist where steam is the desirable or required medium. The steam can be made at the point of use by any HTHW system. The limiting factor is that the steam pressure must be sufficiently lower than the saturation pressure of the HTHW in order that an economical evaporator can be built. Conversely, the HTHW supply temperature must be high enough under all load conditions to generate steam at the pressures required. Some guide lines are given[2] in Table 2 which will be of assistance in selecting a suitable supply temperature where a particular steam pressure is required. The pressures indicated in the table may be increased slightly but the water flow rate must be increased and the temperature drop decreased.

The converter is in many respects similar to the water-to-water heat exchanger (See Fig. 4). The steel shell is much larger, however, and should be proportioned so that the steam space[2] above the water line is approximately 40 percent of the shell volume. The water line should be located at least 2 in. above the top of the tubes. A dry pipe or some means of moisture separation should be built into the converter.



3 WATER-TO-WATER HEAT EXCHANGERS provide secondary LTHW or MTHW for space heating. Two-way control valve shown here would be replaced with a three-way valve if necessary to provide proper boiler flow. Bulb of temperature controller should be located in shell near LTHW exit for rapid response and to permit sensing a rise in shell temperature when secondary circulation is shut off



4 WATER-TO-STEAM CONVERTERS generate steam for process loads and air heating. Standard boiler trim shown here must be provided. Two-way control valve can replace three-way valve when boiler flow is assured by separate HTHW boiler pump or automatic bypass in district main. Water box should be arranged to permit removal of tube bundle for maintenance with minimum disturbance of the piping connections

The HTHW is circulated through a submerged hairpin tube bundle. Cupro-nickel (90/10) tubes are used because of their resistance to corrosion, which is of most importance on the steam side. Provision should be made to remove the tube bundle for maintenance or replacement without disturbing the piping system.

Use Standard Boiler Trim

The converter must be fitted with standard boiler trim[3] including:

1) blow off valves
2) relief valves
3) water column
4) feed water pump control
5) low water alarm
6) pressure gage

TABLE 2 — STEAM PRESSURES suggested here for various water temperatures result in economical converter design

Supply water temperature, F	Saturation pressure,* psig	Generated steam pressure, psig
300	52	10 to 15
350	120	20 to 40
380	181	40 to 60
400	233	60 to 80
425	311	80 to 100
450	408	100 to 125

**Saturation pressure corresponding to supply temperature.*

The shell and the tube bundle must be constructed in accordance with the ASME code for unfired pressure vessels.

Feedwater is supplied to the converter as it would be in any steam system. A pump set with condensate receiver is often used. In general, the pump is controlled "on" and "off" from the level in the converter. On large steam units, continuous pump operation with a feed water control valve is preferred[2] to control the converter water level. Makeup water as needed is admitted to the condensate receiver by a float-valve.

Steam Side Scale Easy to Remove

Boiling occurs on the smooth exterior surfaces of the tubes in the evaporator. Since all evaporation takes place on the outside of the tubes, any scale that forms is located where removal is relatively easy. Expansion and contraction of the tubes will assist in cracking[2] and removing any scale that does form. Chemical removal is also simple.

Select Unit Heaters Carefully

Unit heaters are one type of heat exchanger employed in direct application of HTHW for space heating. These have been used in Air Force installations[2,5] for heating hangars, warehouses, and service buildings, and in industrial plants[6] for heating manufacturing and service areas.

When used for water temperatures below approximately 300 F, unit heaters of standard designs present no particular problems. Above this temperature and particularly at temperatures of 350 to 400 F they occasionally have given[2,7] problems. These are related to the adaptation of standard designs to the higher pressures and temperatures. Headers of standard heaters are generally not suited to the high pressures. For example, in one installation difficulty was experienced with coil headers cracking open. This failure was attributed[7] to stresses imposed by expansion and contraction of the header. The small heating loads of unit heaters and corresponding small water flow requirements and resultant low velocity reduces the heat transfer capability[2] of standard heaters and special circuiting or velocity increasing devices must be employed. The radiant heat from the high temperature coil has an adverse effect on the motors. Special motor insulation or radiation shielding are required to minimize this.

To insure long life and trouble free operation, some designers recommend that direct use of HTHW at temperatures above 350 F be avoided in standard unit heaters. Secondary distribution of LTHW is used in such cases. This follows standard steam practice[2] as 230 psi steam is seldom used directly on a unit heater without pressure reduction.

The disadvantages of standard designs have been overcome in unit heaters designed especially for HTHW service. These designs employ serpentine tube arrangements, provision for maintaining acceptable motor temperatures, and afford some choice of tube diameters to maintain adequate water velocities. Only those heaters so constructed should be used.

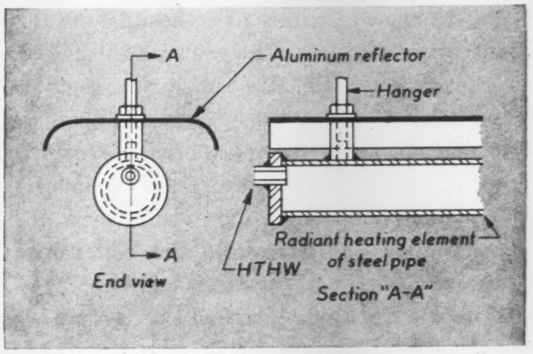
Air Heaters Have Similar Problems

Air heating coils utilizing HTHW have the same basic problems as unit heater coils and require special designs for satisfactory operation. Coils with tubes of steel or red brass welded or brazed to headers of similar materials are suited[3] for the service temperatures and pressures.

When heating air with entering temperature above freezing, no difficulty is experienced. When applied to heat air with entering temperature below freezing and lower, as in makeup air heating, there is considerable risk[2] of freezing the coil. Because of the low mass and, thus, heat content of the coils, a flow interruption of a few seconds can result in freezing and coil damage. Stopping of flow can be a common occurrence in the district system, the principal cause being the stopping of the main circulating pumps. These might be as much as a mile or more from the heating coil. Another cause of flow stoppage would be closing of any sectionalizing valve in the district piping system.

The foregoing remarks indicate the need for freeze protection, especially when heating 100 percent outdoor air. This has been accomplished successfully by using a bypass[9] on the coil to permit a small flow at all times. This will protect against control valve failure but not against failure of the circulating pumps. Another solution is to shut down the fan on a low return temperature, say 100 F. This provides a 70 F margin of safety but still leaves the coils somewhat vulnerable to flow interruptions. Finally, a freezestat in the air stream can be used to sense an undesirable drop in the temperature leaving the air heater.

Because of the possibility of freezing the water coil, water-to-steam converters are sometimes used to generate steam for air heating applications. This introduces an additional heat exchange device but eliminates possible damage to the HTHW system in the event of a freeze-up. The problem of freezing can also be circumvented by employing a secondary heat exchanger



5 TUBULAR RADIANT HEATING element constructed as shown here utilizes HTHW directly for space heating. Rolled aluminum reflector has been replaced in recent designs with an extruded aluminum reflector incorporating provisions to simplify attaching the reflector to the tubular unit

and an aqueous solution of ethylene glycol. The choice of the secondary heating medium will depend among other things upon the total need for steam in a given job.

Many Types of Direct Radiation

Finned tube radiation is available for direct use of HTHW in space heating. These are generally employed at temperatures below 300 F with the reduced temperature obtained by mixing supply and return water through a three-way modulating valve. Covers must be designed to protect occupants and equipment or furniture from burns should they inadvertently contact the radiation. This precaution is not necessarily unique with HTHW as steam radiation presents the same basic hazard and has the capability of producing burns on contact. The difference is only one of degree due to the higher temperature of the HTHW.

HTHW has been used successfully[3,10] in tubular radiant units, which are illustrated in Fig.5. The radiant elements are fabricated of schedule 40 steel pipe in varying diameters from ¾ to 3 in. They must be finished with heat resistant enamel to avoid discoloration. In some applications, they can be installed in a pattern matching and complementing that of the light fixtures. An aluminum reflector must be provided to control the radiation from the upper surface of the tubular element. Such a reflector will tend to minimize smudging of the ceiling or roof deck above the heating element. The reflectors can be eliminated when the ceiling is treated architecturally to serve these same functions. Units of this type have been used with temperatures up to 400 F.

Flat radiant panels of ½ in. steel tubing spot welded to 14 ga. steel sheets have also been used[3] but only with water temperatures up to 340 F at the present time. This is not, however, the upper design limit of the panels and they could be used at higher temperatures. The panels occupy considerable ceiling space as compared to the tubular radiant units. Provision must be made for the expansion of the panels just as it is with the piping system or other heating elements.

Steel radiators have been used with HTHW — principally in Europe.[8] The tubes and headers are fabricated from steel pipe. The headers may consist of 1 in. pipe with tubes of ½ in. pipe welded in at 2 to 3 in. intervals. Flat steel plates which have been rolled and welded together surround the ½ in. pipes, thus enlarging the heating surface. The upper header is covered by a perforated cap which permits air circulation between the pipes and extended surface to keep the temperature of the exposed plates as low as possible. One recent U. S. design employs a finned steel tube arranged in a serpentine coil and a perforated steel enclosure. Air aspirated into the radiator through the perforations maintains a low temperature on the exposed surface.

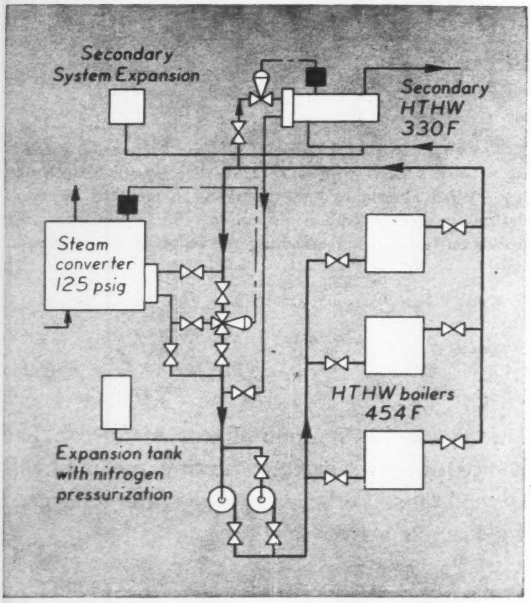
Vary Design to Meet Needs

Many combinations of end use heat exchange equipment may be used when circumstances make such use practical and desirable. Two examples will illustrate somewhat unique applications.

In the modernization of a hospital heating plant when its steam plant was found[3] in need of replacement, a HTHW system was installed. Because of process steam requirements and the fact that not all of the space heating would be accomplished by direct use of HTHW immediately, a high temperature loop was designed that was installed entirely within the boiler room (See Fig. 6). HTHW was generated at 454 F in forced circulation boilers and the system was pressurized with nitrogen to a pressure of about 500 psig. Steam for the kitchens, sterilizers, a laundry, and much of the existing steam radiation is generated by a water-to-steam converter at 125 psig. The HTHW leaves the converter at 364 F.

A water-to-water heat exchanger takes water from the high temperature loop to generate secondary HTHW for space heating. Primary HTHW enters the heat exchanger at 454 F and leaves at 364 F. The secondary water enters at 280 F and is heated to 330 F. The secondary system is also pressurized with nitrogen to a pressure of about 150 psig. A common source of nitrogen is used for the primary and secondary systems. This water is supplied to tubular radiant units of the design described earlier. Ultimately, the entire space heating load will be carried by direct use of secondary high temperature water generated as illustrated in Fig. 6.

In another hospital installation comprised of 15 multi-story buildings on a mile long site, HTHW was selected[2] as the primary heating medium. A typical building heating requirement totals about 25 million Btu per hr. About half of this load is direct radiation for space heating; the remainder is the steam load for the kitchen, sterilization, domestic water heating, and air heating. Since the air heating load of about 7 million Btu per hr was 100 percent outside air, the designer chose to use steam in the air heating coils to circumvent the risk of freezing with water coils. A steam generator was designed to provide required steam at 40 psig with entering and leaving water temperatures of 380 and 310 F, respectively.

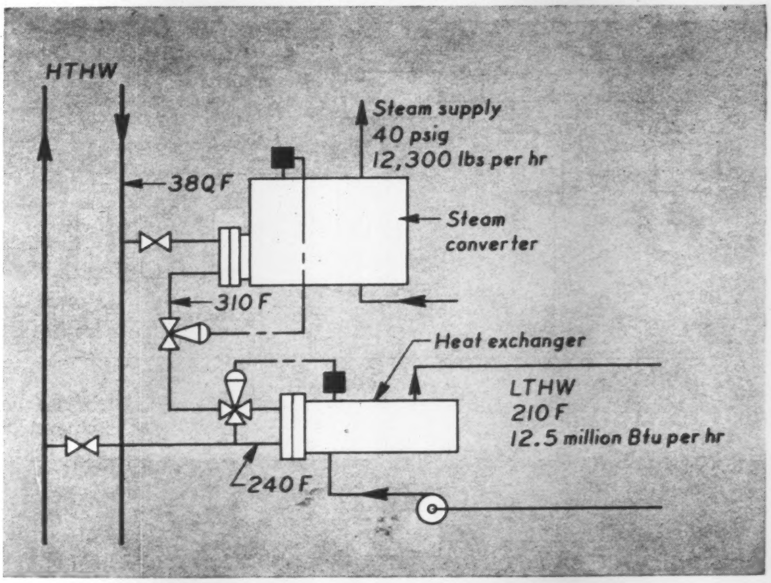

Secondary System Expansion
Secondary HTHW 330F
Steam converter 125 psig
HTHW boilers 454F
Expansion tank with nitrogen pressurization

6 HTHW at 454 F circulates through primary piping system contained entirely in boiler room of system illustrated here. Primary HTHW is used to generate 125 psig steam for hospital's needs and to provide HTHW at 330 F for space heating through a secondary water-to-water heat exchanger. Both the primary and secondary HTHW systems are pressurized with nitrogen from a common source

The tail water from the water-to-steam converter was used in a water-to-water heat exchanger to heat the LTHW for the direct radiation (See Fig. 7). The primary water enters at 310 F and leaves at 240 F while heating the LTHW from 190 to 210 F. This arrangement is possible because the ventilation load and the heating load are directly related to outdoor temperature. The enthalpy difference across the steam generator is 73 Btu per lb while that across the secondary water heat exchanger is 72 Btu per lb. Thus, the tail water off the steam generator can supply all the heat for the secondary circuit.

A second heat exchanger is installed to backup the first in the event that there is insufficient tail water from the steam generator and also to act as a spare. High temperature hot water enters the second heat exchanger at 380 F and leaves at 240 F.

These examples demonstrate the various combinations of components and their arrangement that will help to develop the ultimate economy of the HTHW system. Both illustrate that no fixed pattern can be established on how to use



7 ALMOST EQUAL steam and LTHW loads and the fact that both were dependent upon outdoor temperature permitted use of tail water from steam converter to generate all of the LTHW required. A second LTHW exchanger was provided, however, as a spare and to back-up the first in event that the tail water will not carry the load. Arrangements such as this will help to develop the ultimate economy of HTHW

HTHW. Each job must be studied to determine whether the merits of HTHW can be realized for the particular application and whether the system can be designed to develop the ultimate efficiency of the high temperature hot water system.

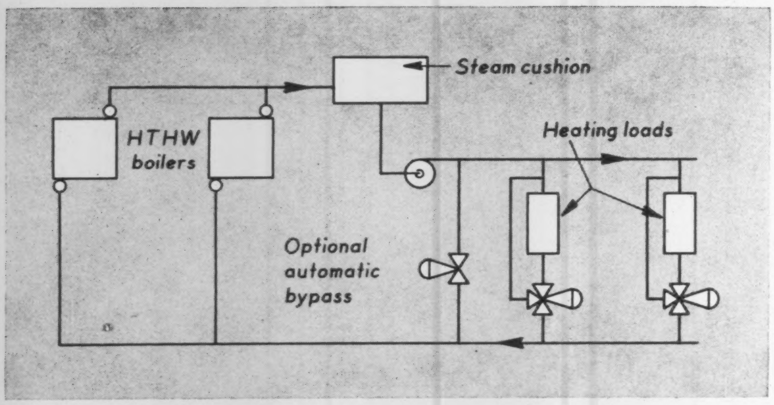
Controlling the HTHW System

Control of the HTHW system is much more critical than that of the conventional water heating system — due to the pressure-temperature relationships that must be maintained at all points in the system to prevent vaporization and resulting water hammer, and the rapid response associated with the higher temperatures and smaller water quantities involved. Various control arrangements are in use. Variations are in part a function of the characteristics of the heat exchange equipment employed. Some of the considerations in designing the control system are outlined below for various end use heat exchange equipment and the central boiler plant. No attention will be given here to control of the secondary LTHW or steam systems served by a HTHW plant through secondary heat exchangers or converters. These follow conventional practice as the high temperature hot water heat exchangers simply replace the direct fired heat exchangers.

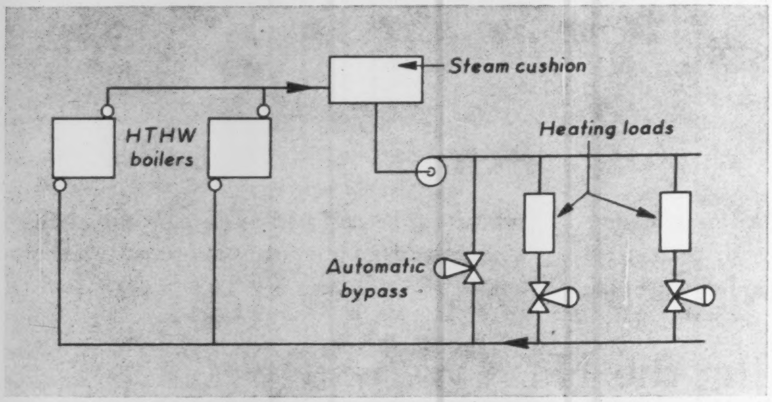
The flow of HTHW to secondary heat exchangers or circuits employing HTHW directly is throttled as required to satisfy the controlled variable — water temperature, steam pressure, or room temperature. Both three-way and two-way valves can be used depending upon the method selected to maintain adequate boiler circulation during periods of light loads when using forced circulation boilers.

Choose Valves to Suit Boiler Circuit

It would be well to review at this point the various boiler flow circuits that can be employed and the way in which the minimum required boiler flow is achieved when flooded boilers with external pressurization vessels are employed. These remarks are not appropriate for the cascade or contact heater boiler circuiting in which steam is generated and boiler flow is controlled on the basis of feed water requirements. In the latter system, the boiler flow is independent of the flow in the HTHW system.



8 TWO-WAY CONTROL VALVES can be used to modulate flow to consumers in single pump system but an automatic bypass must be provided to assure adequate flow to the boilers at all times



9 THREE-WAY CONTROL VALVES assure adequate flow to the boiler in a single pump system. Bypass is optional but may be useful when part of the district piping must be shut down for repair

Two pumping arrangements are commonly used as outlined in the January HPAC Engineering Data File. These are the combination or *single pump* system in which one pump or several in parallel provide flow to the district system as well as to the boilers, and the *dual pump* system in which separate pumps are used for the district and boilers. In the latter case, proper flow to the generators is assured regardless of the flow in the district.

In the combination or single pump system, provision must be made in the piping design to assure adequate flow to the boilers. There are two ways[2] to accomplish this automatically with the typical direct return or reverse return distribution system. When two-way modulating valves are utilized to control the HTHW flow to the consumers, an automatic bypass valve must be installed to bleed water from the supply main to the boiler inlet (See Fig. 8). This valve is operated on the differential pressure between the supply and return mains, or in response to metered boiler flow. The second means of providing proper boiler flow is through the use of three-way control valves. Properly sized, the three-way valves will assure a fairly constant flow in the district system, thus providing the required boiler flow (See Fig. 9). In some cases when using three-way valves, it may be desirable to install an automatic bypass as a safety measure. This valve will be actuated only when a main shutoff valve in the district is closed to facilitate maintenance or for modification of the system. In each design, the choice of control valve type will depend upon the boiler flow circuit selected, the nature of the loads being served, and the relative location of the loads with respect to the central heating plant.

Select High Quality Control Valves

High quality valves are required[3] to control the relatively small flows involved and to assure negligible stem leakage under the pressures and temperatures encountered. Valves of cast or forged steel with stainless steel trim are preferred. Finned cooling bonnets can be employed to minimize the temperature of the stem packing. These are usually recommended when the valve will operate at water temperatures above 400 to 450 F. In some cases, bellows type stem seals may be desirable to prevent stem leakage. At present, valves with bellows stem seals are available in limited pressure and temperature ranges, having been developed principally for handling toxic or valuable liquids at lower temperatures. They have been used in HTHW systems, however. The bellows seal, when used, should be backed up by a packing gland to prevent leakage in the event the bellows fails.

Both the three-way and two-way valves of the single seated type should be selected[3] to assure tight shutoff. Characterized plugs with equal percentage flow characteristics are employed. In most cases, pilot positioners should be provided[2] to increase the number of valve positions. Pneumatically operated valves are most often employed. All control valves should be selected with HTHW supply ports normally closed so the flow to the heat exchangers is shut off in the event of control system failure. In general, where piping configurations permit it, the control valves should be placed on the down stream side of the heat exchangers. This minimizes the possibility of flashing the HTHW to steam due to the abrupt pressure drop in the valve as the valve will be located in the coolest water.

Size Valves Carefully

Control valve sizing is important[2] as an oversized valve will tend to control only over a fraction of its total stem travel. With oversized valves on water or steam converters, small changes of controller impulse will result in large changes in secondary water outlet temperatures or steam pressures. As the pressure drop is a prime factor in valve sizing, all attempts should be made to hold the proper pressure in the supply and return mains. A suggested minimum pressure drop for sizing the control valves is 5 psi. Where the system head allowance for a building is adequate, a 10 psi drop is preferred for better control.

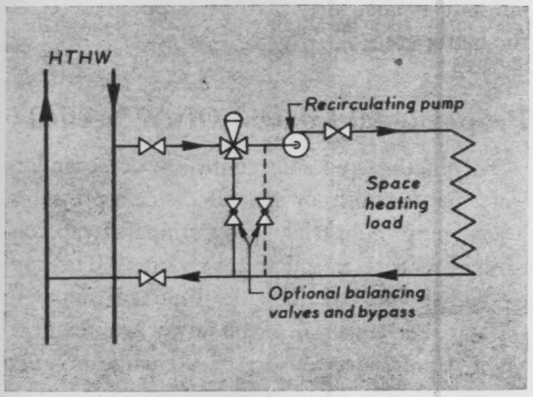
Proportional Control Often Needed

To obtain acceptable control[2,3] of secondary water temperatures or generated steam pressures, heavy duty industrial, proportional type controllers with reset action are required. The controllers should have a wide throttling range so that small changes in secondary water temperature do not cause too drastic a change in valve position. With the wide throttling range, automatic reset action is needed to maintain relatively constant secondary water temperatures or steam pressures in spite of load changes. The reset feature automatically restores the controlled temperature or pressure to the desired value after each load change. Recording controllers with a 1 to 150 or 1 to 200 percent adjustable proportioning band with automatic reset are used for this service.

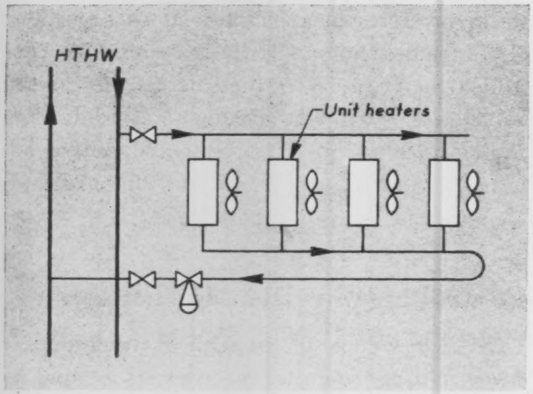
Controlling the Heat Exchangers

The low volume of the shell of the secondary *water-to-water heat exchanger* results in rapid response or change in outlet water temperature and makes the control of HTHW flow difficult[2] if all factors are not considered. This response characteristic establishes the basic need for the proportioning-reset controller and high quality valve. The temperature controller should have its bulb in the shell of the converter rather than in the outlet piping, but the bulb should be located in the flow path to the heater exit. This permits[2] the bulb to rapidly sense changes in temperature and also to spot a rise in temperature in the shell when the secondary circulation is shut off. A typical converter arrangement with a two-way control valve is shown in Fig. 3.

A schematic of a *water-to-steam converter* is shown in Fig. 4. The control requirements of the converter are comparable to those of the secondary water heat exchanger. Steam pressures vary rapidly with changes in load and HTHW flow. A recording pressure controller of the proportional-reset type is used in place of the temperature controller. The pressure controller



10 CONTROL OF HTHW to consumers when supply temperature is held constant can be done as shown here. Mixing of supply and recirculated water from radiation permits modulation of water temperature with changes in secondary load. This system is most suited to the low end of the HTHW temperature range (300 to 350 F). Pressure on radiation approximates that in the mains. The bypass and balancing cocks can be employed to limit the temperature of the water supplied to the space heating units when the supply temperature is too high



11 UNIT HEATER output can be modulated by controlling flow of HTHW as shown here or by controlling fan operation while supplying constant flow of water. Scheme illustrated here minimizes standby losses during light loads and provides better control. Provision must be made to assure equal flow to each heater at all load conditions through reverse return piping as shown or by use of balancing cocks or orifices

senses changes in steam pressure in the converter and throttles the HTHW accordingly to maintain a constant pressure.

Where *domestic hot water* is heated with HTHW and the tank has a large storage capacity, control is not so critical[2] as that in the shell and tube exchanger. In such cases, a simple control valve-aquastat arrangement is suitable. When recovery is large compared to storage, rapid response results and a proportional plus automatic reset temperature recording controller should be employed. The control is then comparable to that for the secondary water heat exchanger, illustrated in Fig. 3.

How to Control Direct Radiation

Direct radiation (finned tube, tubular radiant units, and panels) can be controlled in several ways. A three-way valve and auxiliary pump used in an arrangement[3] similar to that shown in Fig. 10 is useful when the HTHW supply temperature is constant. A master-submaster control system varies the mixed water temperature in accord with the heating load. An alternative arrangement would employ a two-way or three-way valve to control individual zones, with the temperature of the HTHW supply in the district main varied with outdoor temperature. In this case, all connected loads should be a function of outdoor temperature. If they aren't, the design of the heat exchangers for those loads not related to outdoor temperature must be such that they function properly at the reduced water temperatures encountered in mild weather.

Unit heaters can be supplied with a constant water flow, and heat input to the space varied through fan operation. This leads to overheating of the heater and large standby losses during periods of light load. Better control results when the methods used in controlling direct radiation are employed with groups of unit heaters under the control of a single control valve (See Fig. 11). Fan operation should be constant to minimize stratification. Piping must be designed to assure equal distribution of water to every heater under all load conditions.

Air heating coils are controlled as they would be with LTHW. Face and bypass arrangements in conjunction with a control valve are commonly used. As noted earlier when heating makeup air for industrial heating installations or 100 percent outdoor air for ventilation, consideration must be given to freeze protection.

Consider Process Heater Needs

Control of process heating devices requires careful analysis of the characteristics of the equipment and the loading. The selection of controls would be guided by the same reasoning followed in controlling the flow to other consumers. Rapid response with frequent load changes would require the proportional type controller with reset action and either a three-way or two-way modulating valve as required with the overall control arrangement selected. On the other hand, the process equipment may require water at a constant temperature and at a practically constant load, a condition that can be controlled readily with conventional controllers. Process heating requirements often establish the design supply water temperature in HTHW systems in industrial plants and their requirements may preclude any resetting of the boiler outlet temperature in mild weather.

"On - Off" Control of Makeup Pumps

Makeup water requirements in the closed HTHW system are relatively small and are a function of tightness of the system since the only water lost is due to leakage at packing glands, etc. As a result, "on-off" control of the makeup pumps is used to maintain[2,3] a predetermined minimum level in the expansion vessel in either the steam or nitrogen pressurized systems. In the cascade system, the makeup water pumps[11] are controlled by a level controller located in the contact heater.

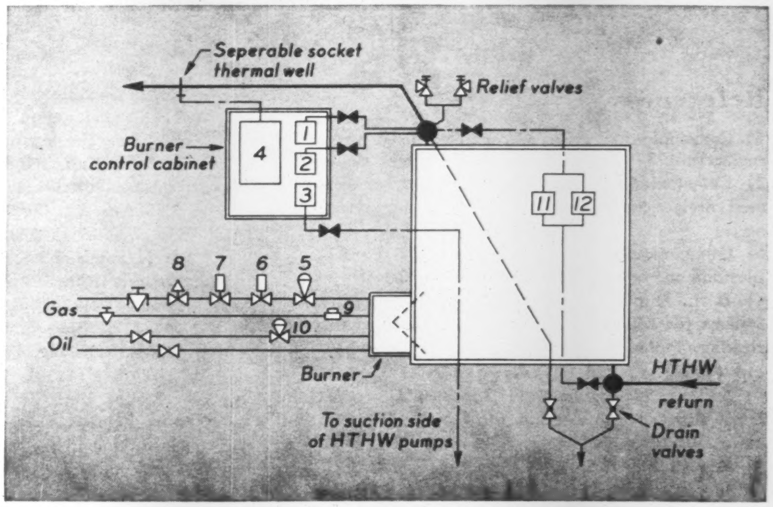
Controlling the HTHW Boiler

Controls for the HTHW boiler may be divided into two groups; those which are provided to control the firing rate and those which are employed as safety controls to stop the firing under unusual circumstances.

Two methods[8] can be used to modulate the boiler firing rate to meet the system heating requirements. These are:

1) Firing to maintain an outlet temperature sufficient to match the heating load.

2) Firing to maintain a constant boiler outlet



12 HTHW BOILER controls shown here are typical of those needed for gas and oil fired boilers in gas pressurized systems. Controls are: 1) high pressure cut-out, 2) high temperature cut-out, 3) low pressure cut-out, 4) temperature controller (pressure controller on steam pressurized systems), 5) modulating gas control valve, 6) slow acting solenoid valve, 7) quick acting solenoid valve, 8) pressure regulating valve, 9) pilot solenoid valve, 10) modulating oil valve, 11) pressure differential gage, 12) low pressure differential (low boiler water flow) cut-out. Burner is also stopped on low water level in expansion tank temperature and varying the supply temperature of the district flow or the flow to each consumer in accord with the demand.

The second method is common practice and is preferred[8] because:

1) A constant boiler outlet temperature is often required for process heating or steam generation.

2) Firing is more economical when the boiler outlet temperature is held constant.

While it is indicated above that the boiler outlet temperature is held constant, in the steam pressurized system[12] the master controller should sense the pressure in the expansion tank and adjust the firing rate to keep the pressure constant. The pressure impulse on a given boiler should receive a corrective impulse from a control sensing boiler outlet temperature so that uniform boiler outlet temperatures can be maintained when two or more boilers are in operation. This is needed to maintain equal steam-water ratios leaving each boiler. If this is not done, the steam in the flow from the boiler of higher firing rate will be condensed when it mixes with the flow from the boiler of lower firing rate and a low order water hammer can occur. In the gas pressurized system[3] with the expansion tank arranged to "float" on the return line, the master controller maintains a constant boiler outlet temperature. The master controller — either pressure or temperature — should modulate both fuel input rate and air-fuel ratio for maximum combustion efficiency.

Combustion controls including programmed starting and flame failure control are needed with gas and oil firing as they would be on any plant of comparable size. In addition to the safety controls provided by the combustion control system, controls should be provided[2,3,4] to shut down the burners automatically in the event of such unusual circumstances as:

1) High outlet temperature
2) High outlet pressure
3) Low pressure at the pump suction
4) Low water level in the expansion vessel
5) Forced draft fan failure
6) Low pressure differential on the boiler (low boiler water flow rate)

A typical control arrangement for forced circulation boilers in a gas pressurized system is shown in Fig. 12. Comparable controls are required in coal burning installations.

Combustion controls and those required for safety in systems employing steam raising boilers and contact heaters should be similar[11] to those used on steam plants of comparable size.

[The editors wish to acknowledge the assistance of the consulting engineers and others who cooperated in the preparation of this report by providing the information included herein. Table 1 was provided by Georg Stabenow. Figures 2, 3 and 7 and Table 2 were provided by William T. O'Reilly. Figures 4, 5, 6, 10, and 12 were provided by John S. Blossom. This discussion of HTHW will be continued in a future issue, at which time the need for water treatment in HTHW systems, safety considerations in using it, and operation and maintenance will be discussed.]

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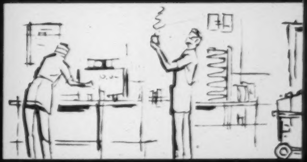

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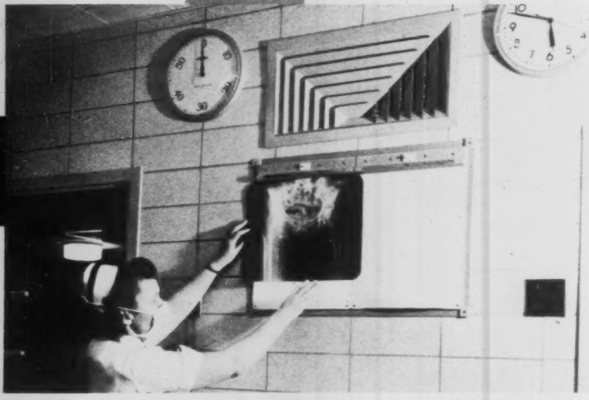

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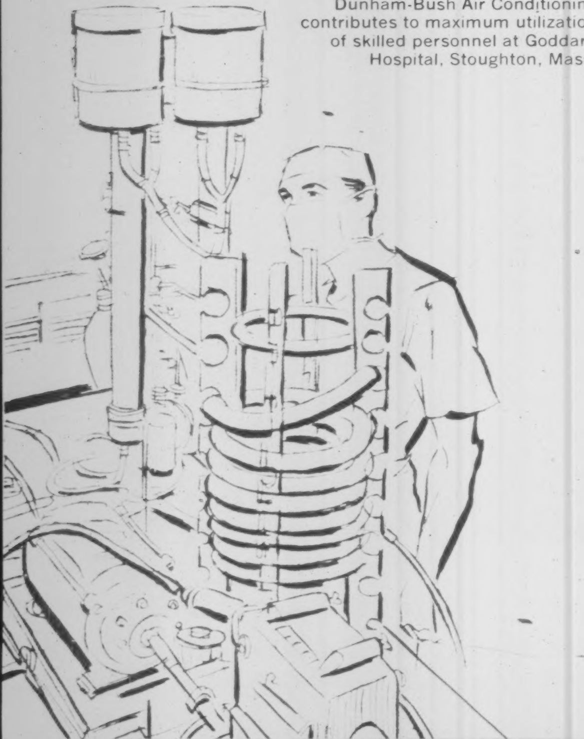

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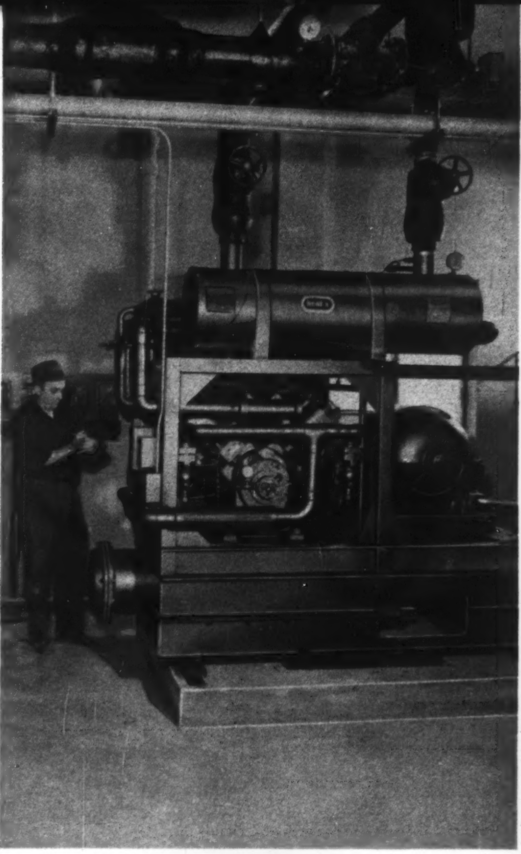
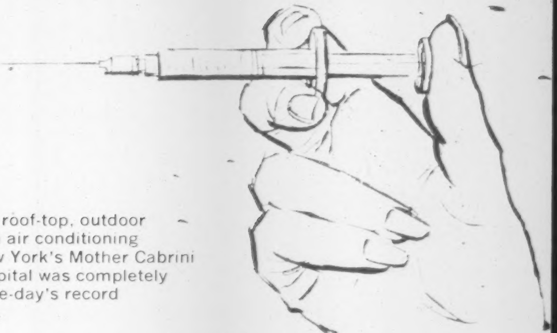
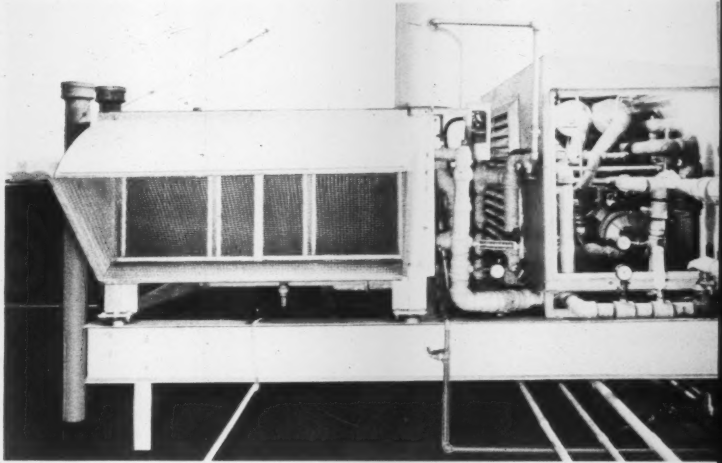


Heat-X (a Dunham-Bush subsidiary) Package Chiller, integral part of Clark County Memorial Hospital's Dunham-Bush air conditioning system. Location is Jeffersonville, Indiana.

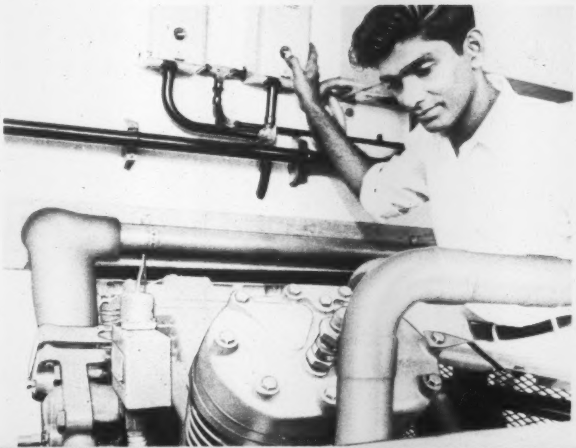


Space saving, roof-top, outdoor Dunham-Bush air conditioning system at New York's Mother Cabrini Memorial Hospital was completely installed in one-day's record breaking time.



New-arrivals find the world a comfortable place when their hospital room has a year 'round room air conditioning unit. This Dunham-Bush product furnishes both warm and cool air with individual room control.

You'll find Dunham-Bush products in far-away hospitals, too. Brunner (a Dunham-Bush Division) compressors air condition General Hospital of Ceylon in Columbo. This is Ceylon's largest hospital.



Refrigeration Products

HOSPITAL NAMES ATTEST TO RECOGNITION OF DUNHAM-BUSH PRODUCT DEPENDABILITY

using such DUNHAM-BUSH *products as . . .*

- COOLING PRODUCTS
  - Unit Coolers
  - Product Coolers
  - Plasti-Coolers
  - Gravity Coils
  - Comfort Coolers
  - Air Handling Units
  - LRCU' Large Remote Condensing Units
  - Low Temperature Units
  - 'DX', Water, Steam Coils
  - Multizone Units
  - Cooling Towers
  - Evaporative Condensers
  - Packaged Air Conditioners
- HEATING PRODUCTS
  - Steam & Hot Water Specialties
  - Convectors
  - Vari-Vac
  - Unit Heaters
  - Pumps
  - Baseboard Radiation
  - Finned Radiation
- HEAT-X PRODUCTS
  - Liquid Cooling Equipment
  - Heat Interchangers
  - Condensers
  - Package Chillers
  - Industrial Heat Exchangers
- BRUNNER PRODUCTS
  - Refrigeration & Air Conditioning Condensing Units
  - Air Compressors

A sampling of Hospitals . . .

Misericordia Hospital, Bronx, N.Y.
Akron General Hospital, Akron, Ohio
Maimonides Hospital, Brooklyn, N.Y.
V.A. Hospital, Omaha, Nebraska
U.S. Veterans Hospital, Coatesville, Pa.
Misericordia Hospital, West Philadelphia, Pa.
Cooper Hospital, Camden, New Jersey
DePaul Hospital, St. Louis, Missouri
Cardinal Glennon Memorial Hospital for Children, St. Louis, Mo.
St. Mary's Hospital, Cairo, Illinois
Methodist Hospital, Memphis, Tenn.
Akron City Hospital, Akron, Ohio
St. Joseph's Hospital, Memphis, Tenn.
St. Francis Hospital, Wichita, Kansas
Wichita Hospital, Wichita, Kansas
Holzer Hospital and Clinic, Gallipolis, Ohio
Women's Hospital, Detroit, Michigan
Akron Clinic, Akron, Ohio
Henry Ford Hospital, Detroit, Michigan
Morrell Hospital, Lakeland, Florida
Morton Plant Hospital, Clearwater, Florida
Phoebe Putney Hospital, Albany, Georgia
Guernsey Memorial Hospital, Cambridge, Ohio
Grady Memorial Hospital, Atlanta, Georgia
Presbyterian Hospital, Charlotte, N.C.
Tri-City Hospital, Leaksville, N.C.
Vaughn Memorial Hospital, Selma, Alabama
Thomas Hospital, Fairhope, Alabama
National Institute of Health, Bethesda, Maryland
Johns Hopkins Hospital, Baltimore, Md.
Walter Reed Army Medical Center, Washington, D.C.
St. Elizabeth Hospital, Washington, D.C.
St. Mary's Hospital, Evansville, Indiana
Trumbull Memorial Hospital, Warren, Ohio
Logansport Hospital, Logansport, Indiana
St. Mary's Hospital, Huntington, West Virginia
Huntington State Hospital, Huntington, West Virginia
St. Vincents Hospital, Los Angeles, California
Queen of Angels Hospital, Los Angeles, Calif.
Mitchell County Memorial Hospital, Osage, Iowa
Pella Community Hospital, Pella, Iowa
Veterans Hospital, Fort Mead, South Dakota
Northwestern Hospital, Minneapolis, Minn.
Columbia Hospital, Pittsburgh, Penna.
Fairview Hospital, Minneapolis, Minn.
Latter Day Saints Hospital, Salt Lake City, Utah
Utah Valley Hospital, Provo, Utah
Latter Day Saints Hospital, Idaho Falls, Idaho
Monte Fiore Hospital, Pittsburgh, Penna.
St. Alphonse Hospital, Boise, Idaho
Springfield Hospital, Springfield, Mass.
Springfield Medical Center, Springfield, Mass.
Mary Fletcher Hospital, Burlington, Vermont
Henry W. Putnam Memorial Hospital, Bennington, Vermont
Parkchester Hospital, Bronx, N.Y.
Suburban Community Hospital, Cleveland, Ohio
Lenox Hill Hospital, Manhattan, N.Y.
Valley Hospital, Ridgewood, N.J.
Einstein Medical Center, Philadelphia, Pa.
Rolling Hills Hospital, Elkins Park, Pa.
Faith Hospital, St. Louis, Mo.
Lutheran Hospital, St. Louis, Mo.
West Tennessee Tuberculosis Hospital, Memphis, Tennessee
Baptist Hospital, Memphis, Tennessee
St. Joseph Hospital, Wichita, Kansas
Massilon State Hospital, Massilon, Ohio
Wesley Hospital, Wichita, Kansas
Mt. Carmel Hospital, Detroit, Michigan
Sinai Hospital, Detroit, Michigan
Florida State Mental Hospital, Chattahoochee, Florida
Duval Medical Center, Jacksonville, Florida
Emory University Hospital, Decatur, Georgia
Hall County Memorial Hospital, Gainesville, Georgia
Lula Hoots Memorial Hospital, Yadkinville, N.C.
Jewish Convalescent Hospital, Cleveland, Ohio
Grace Hartley Memorial Hospital, Banner Elk, N.C.
Boaz Albertville Hospital, Boaz, Alabama
Washington Medical Center, Washington, D.C.
Union Memorial Hospital, Baltimore, Md.
Buffalo State Hospital, Buffalo, New York
Maryland General Hospital, Baltimore, Md.
Henry County Hospital, New Castle, Indiana
Christ Hospital, Cincinnati, Ohio
Childrens Hospital, Cincinnati, Ohio
Thomas Memorial Hospital, Charleston, West Virginia
Morris Memorial Hospital, Milton, West Virginia
Lark Ellen Hospital, W. Covina, Calif.
Roswell Park Mem. Institute, Buffalo, New York
Mount Sinai Hospital, Los Angeles, Calif.
Mercy Hospital, Des Moines, Iowa
Highland Hospital, Rochester, New York
Schoitz Hospital, Waterloo, Iowa
St. Mary's Hospital, Rochester, Minn.
Rochester General Hospital, Rochester, New York
St. Mary's Hospital, Duluth, Minn.
Carbon County Hospital, Price, Utah
Bellevue Hospital, Manhattan, N.Y.
Strong Memorial Hospital, Rochester, New York
Mt. Sinai Hospital, Manhattan, N.Y.
Valley Forge Hospital, Valley Forge, Pa.
Methodist Hospital, Philadelphia, Pa.
Veterans Administration Hospital, St. Louis, Mo.
Newark-Wayne Community Hospital, Newark, New York
Deaconess Hospital, St. Louis, Mo.
Veterans Administration M.T.G., Memphis, Tenn.
Veterans Hospital, Wichita, Kansas
University of Kansas Medical Center, Kansas City, Kansas
Pontiac General Hospital, Pontiac, Michigan
Oakland County T.B. Hospital, Pontiac, Michigan
N.E. Florida State Mental Hospital, Macclenny, Florida
V.A. Hospital, Bay Pines, Florida
Talmadge Hospital, Augusta, Georgia
Wills Menorial Hospital, Washington, Georgia
Church Home Hospital, Baltimore, Md.
Wyoming County Comm. Hospital, Warsaw, New York
Bon Secours Hospital, Baltimore, Md.
Good Samaritan Hospital, Cincinnati, Ohio
Fairview State Hospital, Costa Mesa, Calif.
St. Joseph's Hospital, Keokuk, Iowa
Good Samaritan Hospital, Sandusky, Ohio
Waukon Hospital, Waukon, Iowa
St. Joseph's Hospital, St. Paul, Minn.
Anker Hospital, St. Paul, Minn.
University of California, Medical Center Hospital, San Francisco
Memorial Hospital, Albany, N.Y.
Albany Hospital, Albany, N.Y.
Philadelphia Oncologic Hospital, Philadelphia, Pa.
Chestnut Hill Hospital, Chestnut Hill, Philadelphia, Pa.
Firmin DesLoge Hospital, St. Louis, Mo
V.A. Hospital, Poplar Bluff, Mo.
Providence Hospital, Kansas City, Kansas
V.A. Hospital, Topeka, Kansas
V.A. Hospital, Dearborn, Michigan
V.A. Hospital, Brecksville, Ohio
Oakwood Hospital, Dearborn, Michigan
Orange Hospital (Nurses Home), Orlando, Florida
South Florida State Hospital, West Hollywood, Florida
Mount Wilson State Hospital, Mt. Wilson, Md.
Memorial Hospital, Fremont, Ohio
Saint Vincents Hospital, Baltimore, Md.
Blank Memorial Hospital, Des Moines, Iowa
Benjamin Rose Hospital, Cleveland, Ohio
Iowa University Hospital School, Iowa City, Iowa
St. Luke's Hospital, St. Paul, Minnesota
Memorial Hospital, Red Wing, Minnesota
St. Francis Hospital, San Francisco, Calif.
Spring Branch Hospital, Houston, Texas
Sonoma State Hospital, Eldridge, Calif.
St. Marks Hospital, Salt Lake City, Utah
Jeff Davis Hospital, Houston, Texas
Holy Cross Hospital, Salt Lake City, Utah
Veterans Hospital, Albany, N.Y.
V.A. Hospital, Gulfport, Mississippi
N.Y. State Health Lab., Albany, N.Y.
Sacred Heart Hospital, Philadelphia, Pa.
Missouri Delta Community Hospital, Sikeston, Mo.
Missouri State Hospital, Fulton, Mo.
Riley County Hospital, Manhattan, Kansas
V.A. Hospital, Ann Arbor, Michigan
V.A. Hospital, Houston, Texas
Michigan School of Public Health, Ann Arbor, Michigan
S. Broward Hospital & Clinic, Dania, Florida
St. Ansgar Hospital, Moorhead, Minn.
St. Joseph's Hospital, Houston, Texas
Willmar State Hospital, Willmar, Minnesota
Washington Township Hospital, Centerville, Calif.
Matteawan State Hospital, Beacon, N.Y.
Charity Hospital, New Orleans, Louisiana
Cohoes Memorial Hospital, Cohoes, N.Y.
John J. Pershing Memorial, Brookfield, Missouri
Teaching Hospital University of Mo., Columbia, Mo.
University of Michigan Hospital, Ann Arbor, Michigan
Foote Memorial Hospital, Jackson, Michigan
University of Maryland State Hospital, Baltimore, Md.
Stella Maris Hospice, Townson, Md.
Veterans Hospital, Tupper Lake, N.Y.
Trinity Lutheran Hospital, Kansas City, Mo.
Boone County Hospital, Columbia, Mo.
St. Johns Hospital, Detroit, Michigan
V.A. Hospital, Oklahoma City, Oklahoma
Providence Hospital, Detroit, Michigan
Jessups Reform for Women Hospital, Jessups, Maryland
Western Maryland Chronic Disease Hospital, Hagerstown, Md.
Memorial Hospital of Queens, Jamaica, N.Y.
County Hospital, Fort Stockton, Texas
St. Anthony's Hospital, Queens, N.Y.
V.A. Hospital, Kansas City, Mo.
Queen of the World Hospital, Kansas City, Mo.
Mercy Hospital, Cadillac, Michigan
Herman Kiefer Hospital, Detroit, Michigan
St. Vincents Hospital, New York, N.Y.
Grace Hospital, Detroit, Michigan
Jewish Medical Center, Baltimore, Md.
Massachusetts General Hospital, Boston, Massachusetts
Bronson Methodist Hospital, Kalamazoo, Michigan
Butterworth Hospital, Grand Rapids, Michigan
Goddard Hospital, Stoughton, Mass.

Considering hospital building or modernization? Write for name of your near-by Dunham-Bush engineer. He can be extremely helpful.

DUNHAM-BUSH

Dunham-Bush, Inc.

179 SOUTH STREET • WEST HARTFORD, 10 • CONNECTICUT, U.S.A.

MICHIGAN CITY, INDIANA • MARSHALLTOWN, IOWA • RIVERSIDE, CALIFORNIA

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heat-x HEAT-X, INC. BREWSTER, N.Y.
BRUNNER — BRUNNER DIVISION WEST HARTFORD, CONN.
DUNHAM-BUSH (CANADA), LTD. TORONTO, CANADA
DUNHAM-BUSH, LTD. PORTSMOUTH, ENGLAND
BRUNNER CORPORATION (CANADA) LTD. PORT HOPE, ONTARIO

FORM NO. 514

110M 1/60 G PRINTED IN U.S.A.

If you're a heads-up, both-feet-on-the-ground kind of man who knows his way around in business – you're sold on your businesspaper. You know from profitable experience, there's nothing else in print so packed with facts, news, and good ideas that help you stay on top in business as the advertising and editorial pages of . . . your businesspaper.

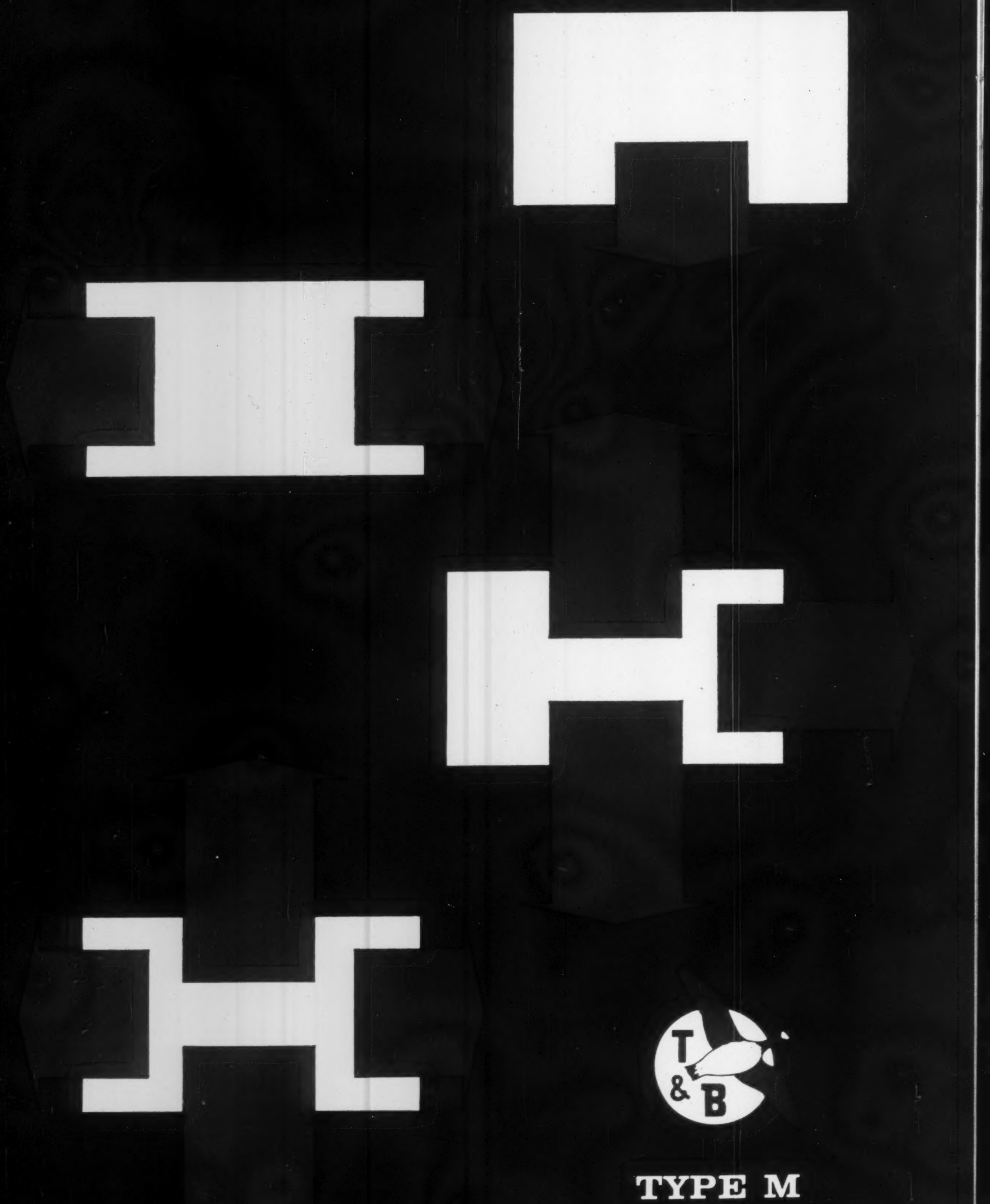
PHOTO ON LOCATION BY EHRENBERG

Where there's business action, there's a businesspaper . . . where there's heating, piping, and air conditioning business, there's Heating, Piping and Air Conditioning

BUSINESS PAPER ABP LEADERSHIP

AUDITED PAID ABC CIRCULATION

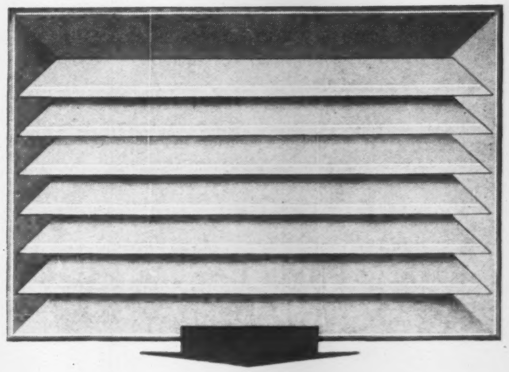
of a series of advertisements prepared by the ASSOCIATED BUSINESS PUBLICATIONS

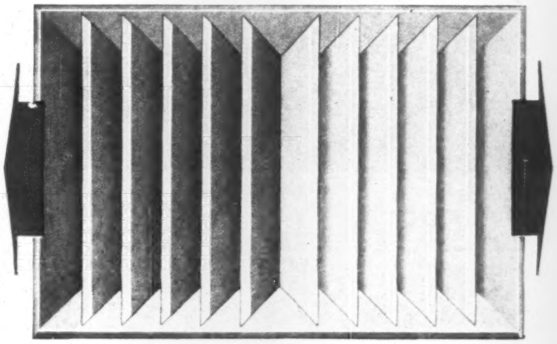


TYPE M

Multi-Pattern Diffusers

The extreme flexibility of Type M Multi-Pattern Diffusers *means custom-selected air distribution*


TYPE M 1-WAY BLOW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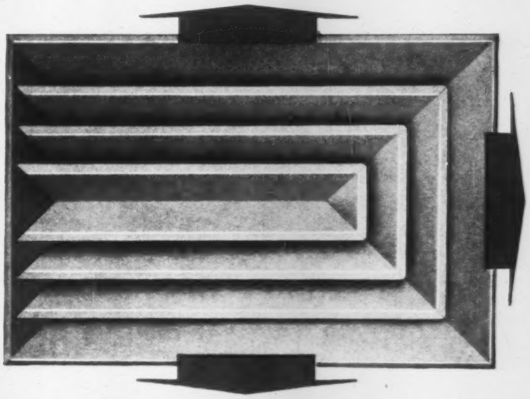
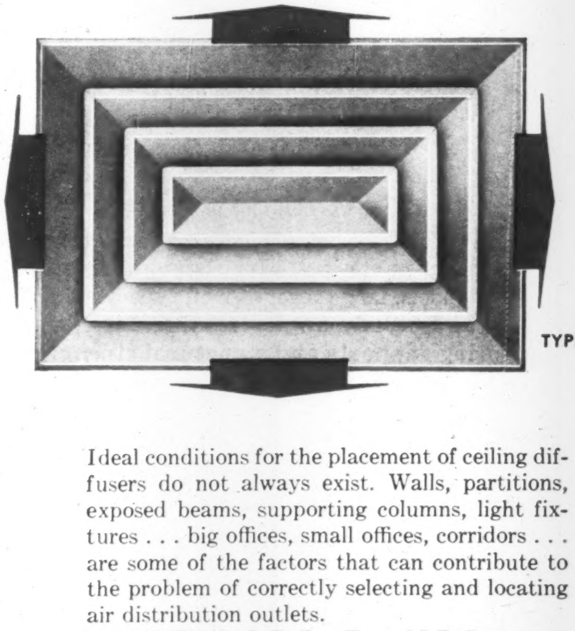

TYPE M 3-WAY BLOW


TYPE M 4-WAY BLOW

Ideal conditions for the placement of ceiling diffusers do not always exist. Walls, partitions, exposed beams, supporting columns, light fixtures . . . big offices, small offices, corridors . . . are some of the factors that can contribute to the problem of correctly selecting and locating air distribution outlets.

With Tuttle & Bailey Type M Diffusers . . . you can select units that will distribute air in a one-, two-, three-, or four-way pattern . . . and you can select from a wide range of square and rectangular sizes. An added advantage . . . if and when requirements change in the conditioned space, it is an easy matter to install a core with a different air pattern arrangement.

T & B Type M Diffusers are attractively styled and can be furnished with four margin styles . . . beveled, flat, flush, or drop-collar . . . designed for various types of ceiling mountings.

For complete details, see your nearest Tuttle & Bailey Representative or write us direct.

TUTTLE & BAILEY

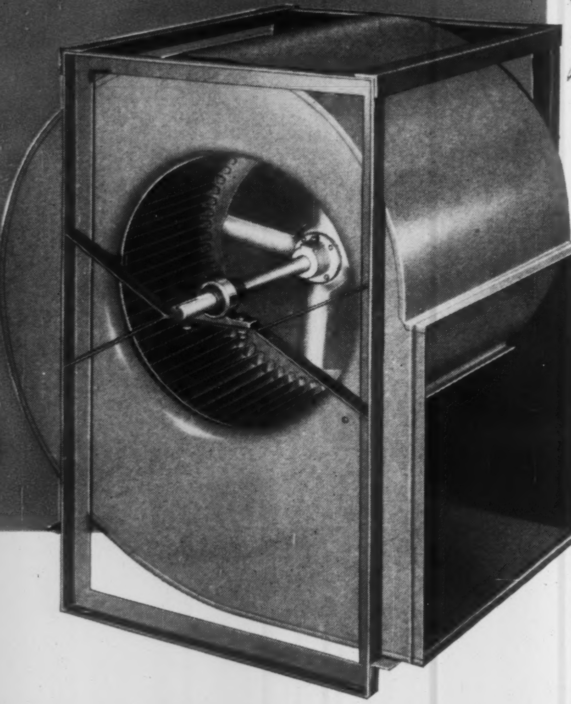
division of Allied Thermal Corp. New Britain, Connecticut

Tuttle & Bailey Pacific, Incorporated, City of Industry, California

LAU

SERIES A
22", 25" and 30"

DESIGNED FOR COMMERCIAL INSTALLATIONS



Built-in flexibility makes the Lau "Series A" the number one choice for commercial and industrial installations. With a C.F.M. range of from 8,000 to 36,000, this efficient unit may be used in many different sizes and types of air conditioning systems. For even greater C.F.M. capacity and flexibility the "Series A" may be operated in banks of two or three.

The "Series A" features such quality Lau parts as heavy gauge riveted wheels, large reservoir oil type bearings and sturdy angle framing for housing supports and structural strength. "Series A" blowers provide for either top or rear mounting motor.

Call or write Lau today for more complete and detailed information.

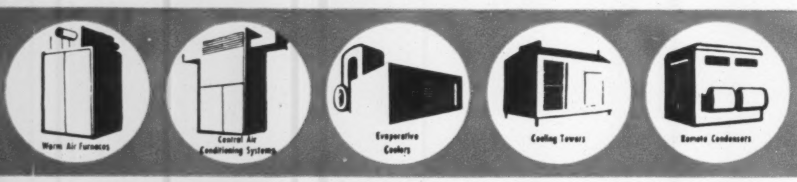
MEMBER
NATIONAL WARM AIR HEATING
INDOOR COMFORT
AND AIR CONDITIONING ASSOCIATION

The Lau Blower Company, 2027 Home Avenue, Dayton 7, Ohio.

Other plants in Kitchener, Ont., Can., and Irwindale, Calif.

LAU

World's Largest manufacturers of Air-Conditioning Blowers for



MSA reports on:

How Air Filter Efficiency Is Tested

MSA presents the following information in a spirit of helpful enlightenment. It's directed to those of you in industry who want to know more about air filter efficiency and how it's determined. A review of this report may pose a question or two in your mind. We hope you will write us for answers to your specific air cleaning problems.

TESTS BASED ON WEIGHT—Efficiency equals total weight of dust in unfiltered air stream divided into total weight of dust stopped by filter, times 100.

The best known weight tests used today are the ASHVE and Bureau of Mines procedures. Both use prepared "standard" dusts of relatively large particle diameter. Most sources agree that "atmospheric dust" would be the most representative material to use on a weight test for space filters. But so far, the average atmospheric dust condition has not been selected. Type of material, concentration, particle size, etc., varies widely from one location to another. And even within the same location from time to time.

TESTS BASED ON DISCOLORING—Efficiency is found by comparing previously rated standard stains.

These tests follow the practice of comparing stains produced on white filter paper by the exit of air from the filter being tested with a series of known standards made by staining papers with different volumes of untreated aerosols.

Comparisons are made visually or by a densitometer (degree of light penetration). NBS or ASHVE dusts are most frequently used on these tests although some reports are based on use of atmospheric dusts.

Efficiencies reported by discoloration are usually lower than those reported by weight; but considerably higher than those obtained by count.

TESTS BASED ON COUNT—Efficiency equals total number of particles in unfiltered air stream divided into total number of particles stopped by filter, times 100.

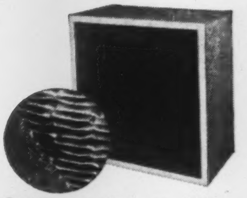
Efficiencies obtained by count are the most exacting measure of a filter performance since large and small particles are rated equally. They can be counted by means of a microscope or by light scattering techniques.

The most critical standard test and the most difficult for any particulate filter is the Chemical Corps DOP test on which penetration of the 0.3 micron diameter smoke particles is evaluated by particle count.

The DOP Penetrometer, used on the M-S-A UltraAire Space Filter, is now considered the most convenient tester available. It is sensitive to penetrations as low as 0.001% by count. It's sometimes difficult to appreciate the difference between 99.95% efficiency and 99.90% efficiency.

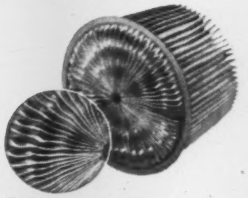
TESTS BASED ON RADIOACTIVITY—Efficiency equals radioactivity of unfiltered air stream divided into radioactivity of particles stopped by filter, times 100.

One of the earlier tests on this basis involved the use of triphenyl phosphate containing radioactive sulphur. This or like materials in a uniform aerosol are passed through filter paper or pads, and segments of these are analyzed with a Geiger Counter or some other similar instrument. Such test procedures are still confined primarily to AEC activities.



M-S-A® UltraAire* Space Filter

Light weight, fire-resistant, unusually strong, and ideal for high humidity service. Individually pre-tested and proved at least 99.97% efficient in removing particles of 0.3 micron diameter.

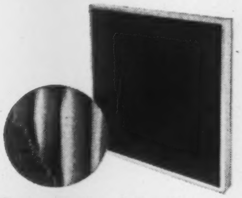


M-S-A® Cylindrical-Type UltraAire* Space Filter

Honeycomb-type fold without separators is admirably suited to cylindrical element construction. This shape is preferred for pressure systems. Weighs only one pound. Easy to handle. Inexpensive to ship.

M-S-A® Dustfoe* Space Filter

Offers the efficiency of an Electrostatic Precipitator without the high cost and without the possibility of arcing "blow-off." 85-95% certified efficiency on NBS Atmospheric Air Dust Stain Rating.



M-S-A® Air-O-Kay* PreFilter

Impingement type panel prefilter which can be used oiled or dry to remove lint and other large air-borne particles from the atmosphere. 60-70% certified efficiency on NBS Stain Rating.

*Trademark

Write for illustrated technical bulletins on M-S-A Space Filters related to your particular system problem. Ask an MSA Representative for system recommendations.

Fluid Purification Specialists For 45 Years

MINE SAFETY APPLIANCES COMPANY

201 North Braddock Avenue, Pittsburgh 8, Pa.

Other Fluid Purification Equipment includes catalytic filters for jet aircraft cabin air; air separation plants; inert gas generators, space capsules; bomb shelters; air line filters; jet fuel and hydraulic fluid purification.

Specify SKIDMORE

FOR PUMP PERFORMANCE NOT PUMP PROMISES

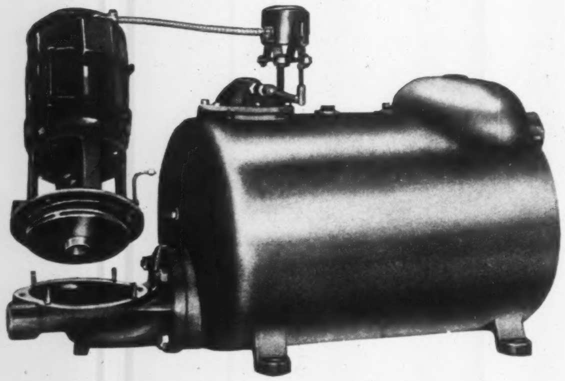
TWO OUTSTANDING SKIDMORE PUMPS THAT HAVE STOOD THE PERFORMANCE TEST!

1 Easily Accessible • • • • • • Compactly Designed

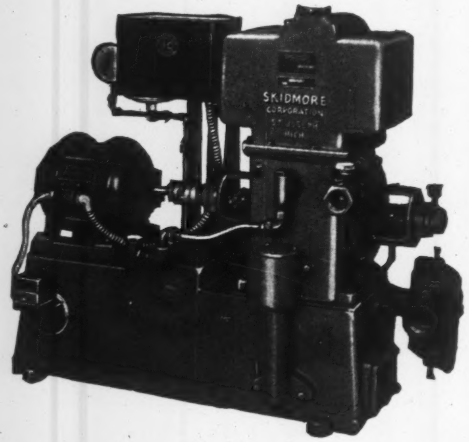
2 Maintained Efficiency

MAINTAINED SKIDMORE PUMPS EFFICIENCY

Year After Year



TYPE VC, SINGLE UNIT — low inlet connection . . . quiet operation.



VACUUM PUMP, SINGLE UNIT — automatically adjusts itself to the varying conditions.

There's a Skidmore Pump designed for each and every heating requirement.

Write for Bulletins

SKIDMORE PUMPS

SPECIFY WITH CONFIDENCE

When you specify "Skidmore" Pumps your good judgment is confirmed by the Skidmore Corporation's more than 40 years reputation and is your assurance that you will obtain pump performance to meet the *exact* requirements of the job.

SKIDMORE CORPORATION ST JOSEPH MICHIGAN

Easy as wrapping a bun around a weenie

LABOR COSTS FOR INSULATING LINES CUT IN HALF BY B.F.GOODRICH CELL-TITE INSULATION TUBING

EVEN when pipe has already been connected, B.F.Goodrich insulation tubing can be slit, snapped on and cemented in seconds. And, if you prefer, you can get it pre-slit for even faster installation. Slitting is unnecessary for new lines—it slips on straight or bent pipe as easily as a ring on your finger. Installation is so fast that labor costs for insulating pipe can be cut 50% or more over old-fashioned twine-wrapping, skirting and other slower methods.

B.F.Goodrich insulation tubing is made of a tough, flexible rubber with millions of uniform, non-connecting cells that seal out air and moisture. It can be used for insulating pipes carrying hot or cold liquids at temperatures ranging from —20°F to 200°F. Clean and easy to work with, doesn't rub off, chip or crumble. It comes in 6-foot lengths, in many wall thicknesses, that are easy to handle, easy to store.

This BFG insulation is also self-extinguishing, so it can be installed on copper tubing before sweat fittings are made—tubing is merely pushed back and held by clamps while joint is soldered.

Try this labor-saving insulation on your next job. For full information on BFG insulation tubing, call your B.F.Goodrich distributor, or contact *The B.F.Goodrich Company, 181 Derby Place, Shelton, Conn.*

INSULATION TUBING BY B.F.Goodrich

A Reliable Way to Judge
a COPPER TUBE Piping System

. . . Look for this Mark JENKINS® of Quality Control

Jenkins Bros

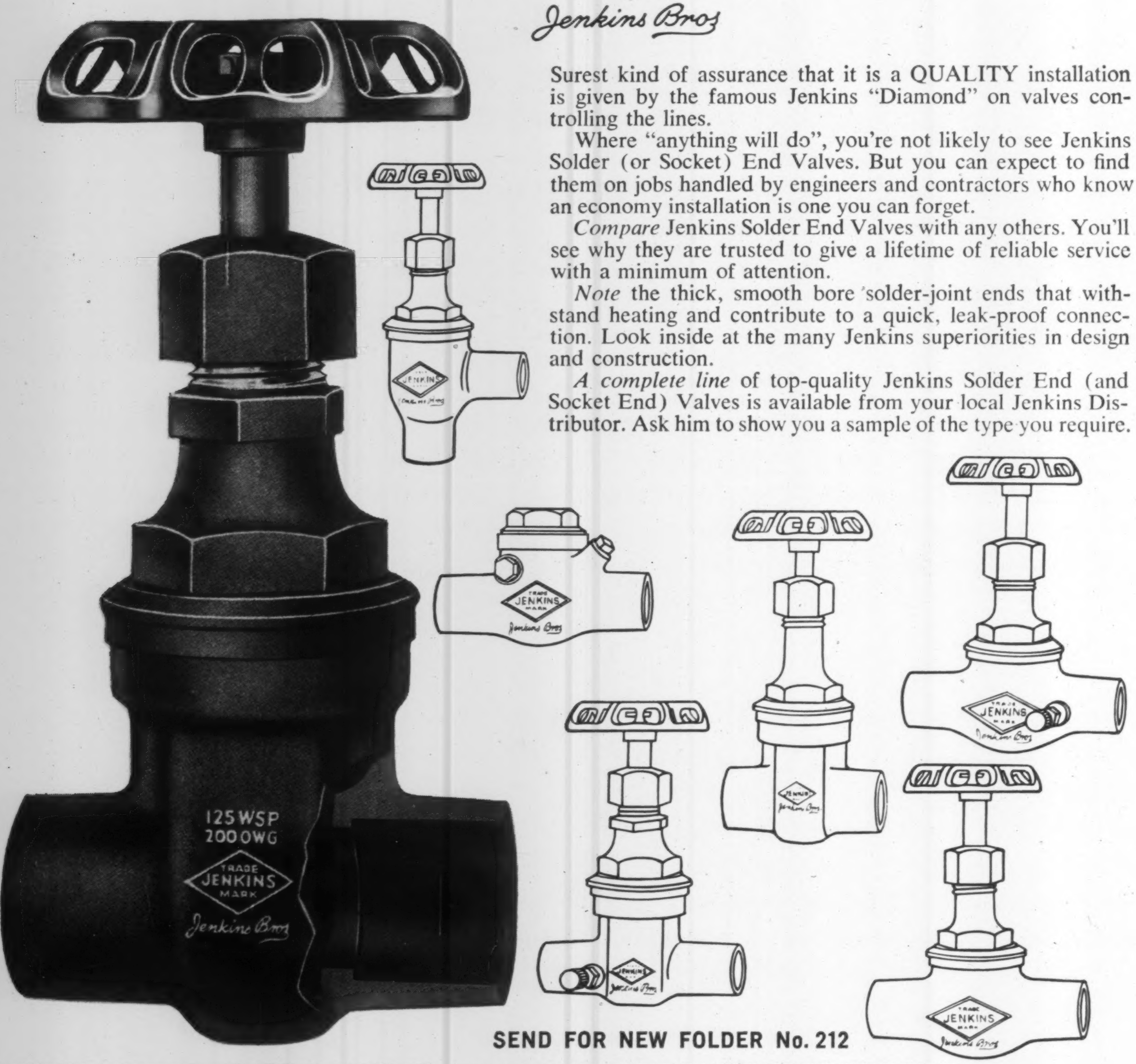
Surest kind of assurance that it is a QUALITY installation is given by the famous Jenkins "Diamond" on valves controlling the lines.

Where "anything will do", you're not likely to see Jenkins Solder (or Socket) End Valves. But you can expect to find them on jobs handled by engineers and contractors who know an economy installation is one you can forget.

Compare Jenkins Solder End Valves with any others. You'll see why they are trusted to give a lifetime of reliable service with a minimum of attention.

Note the thick, smooth bore solder-joint ends that withstand heating and contribute to a quick, leak-proof connection. Look inside at the many Jenkins superiorities in design and construction.

A complete line of top-quality Jenkins Solder End (and Socket End) Valves is available from your local Jenkins Distributor. Ask him to show you a sample of the type you require.



SEND FOR NEW FOLDER No. 212

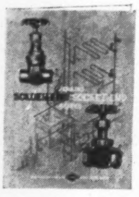
JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS®
SINCE 1864
Jenkins Bros

Jenkins Bros., 100 Park Avenue, New York 17
Send folder No. 212 describing all Solder End and Socket End Valves.

Name & Title..........

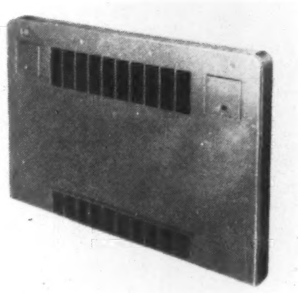
Company..........

Address..........



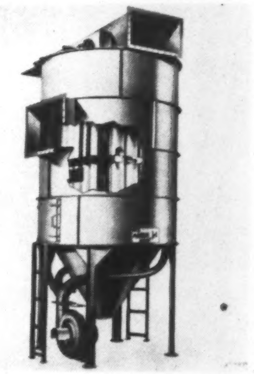
EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see page 238



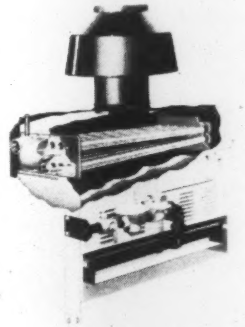
Fan Coil Unit . . .

. . . in four sizes for 5600 to 13,200 Btu per hr cooling with water coil, 16,500 to 55,000 Btu per hr heating capacities; with finished front for total recess or spacers for semi-recessed installations; also available with direct expansion coils in various cooling capacities; bulletin "6014" available on request—*Dunham-Bush, Inc., 179 South St., West Hartford, Conn.*



Dust Collector . . .

. . . uses cylindrical fabric filter bags to reclaim materials in dry state; air enters top plenum, thence to filter bags; heavier dust precipitates to lower hopper while fines are held against bags by air velocity, then dislodged by reverse air stream directed through moving jet case assembly; manufacturer states nearly constant pressure drop can be obtained using this principle; bulletin "279C2" available on request — *American Air Filter Co., Inc., 215 Central Ave., Louisville 8, Ky.*

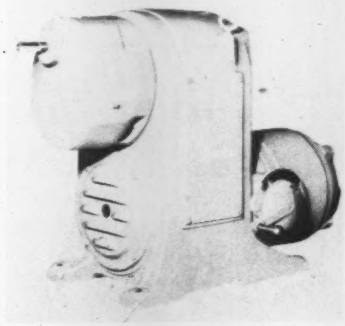


Packaged Boilers . . .

. . . of four-pass design use copper lined tube sheet, bronze headers, operate at 160 psi working pressure; with input ratings of 800,000 to 2½ million Btu per hr; installation of parallel gas modulation valves affords gas modulation down to 5 percent of total input, according to manufacturer—*Raypak Co., Inc.,* 2416 *Chico Ave., El Monte, Calif.*

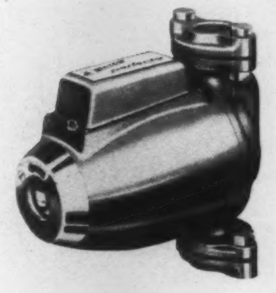
Oil Burner . . .

. . . for use with Nos. 4 and 5 fuel oils has capacity range of 10 to 33 gph with natural or induced draft, 15 to 30 gph on pressurized furnaces; features enclosed completely wired control cabinet, electronic controls, packaged shipment; auxiliary pump unit available for fuel suction from remote storage facilities; can be installed for light oil use and later modification to heavier fuels—*National Airoil Burner Co.,* 1284 *E. Sedgley Ave., Philadelphia* 34, *Pa.*



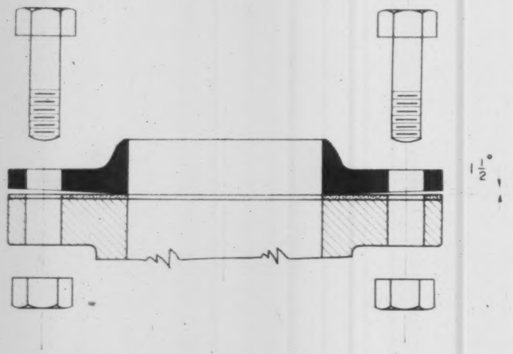
Variable Speed Drive . . .

. . . for operation at speeds from 2500 to 25,000 rpm is available on special order with up to 5 hp enclosed or explosion proof motor; gear increaser and motor are combined in single unit less than 24 in. in height, employ metered lubrication system—*U. S. Electrical Motors, Inc., Box* 2058 *Terminal Annex, Los Angeles* 54, *Calif.*



Water Circulator . . .

. . . with impeller, rotor, and shaft assembled in single unit and water lubricated, said to be suitable for secondary pumping or packaged boiler applications; available with ¾, 1, and 1-¼ in. interchangeable flanges; complete specifications available on request—*Taco Heaters, Inc.,* 1160 *Cranston St., Cranston* 9, *R.I.*

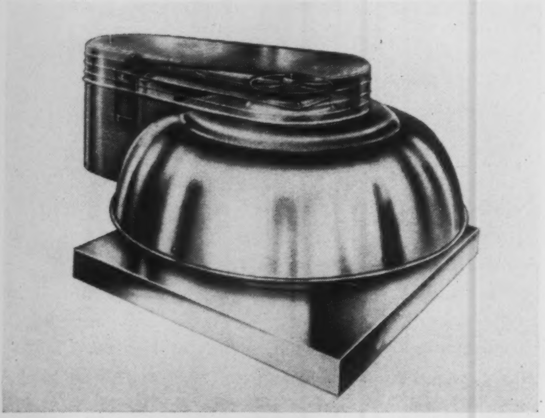


Welding Flanges . . .

. . . in 14 through 24 in. pipe sizes for 150 psi water, oil, or gas and 100 psi steam service, with tapered face for mating to class 125 cast iron flanges with reduced incidence of flange breakage or sealing problems; furnished bored for schedule 10 or standard weight carbon steel pipe sizes; taper feature is said to concentrate gasket pressure near bore, requiring lower sealing force—*Tube Turns Division, Chemetron Corp., 224 E. Broadway, Louisville 1, Ky.*

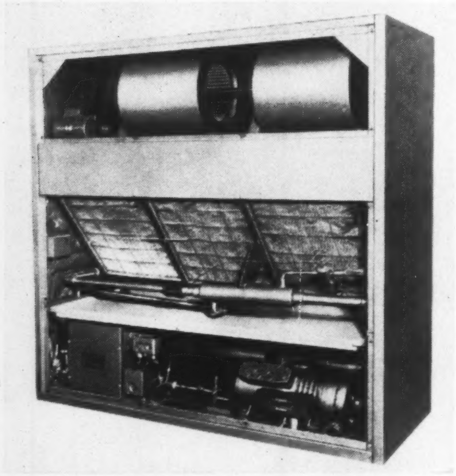
Heater-Ventilators . . .

. . . for use in auditoriums, gymnasiums, other large area rooms, in 16 sizes, 1250 to 15,000 cfm, incorporate acoustical chamber said to afford extremely quiet operation; for hot water or steam, may be installed in horizontal, vertical, or inverted position; catalog "1061" available on request—*Schemenauer Mfg. Co., Holland, O.*



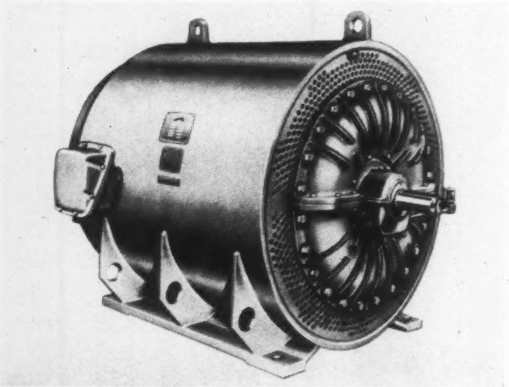
Power Roof Exhausters . . .

. . . in centrifugal and axial fan models with motor and drive assembly side-mounted; two series offer capacities of 725 to 27,000 cfm; feature low profile, hinged motor mounting, adjustable speed pulleys, integral aluminum curb cap, vinyl-coated bird guards; centrifugal wheels are aluminum, axial blades are steel, both mounted on vibration absorbers—*Jenn-Air Products Co., Inc.,* 1102 *Stadium Drive, Indianapolis 7, Ind.*



Packaged Air Conditioners . . .

. . . in 10, 15, 20, 25, and 30 hp models, with panel type casings, lined with glass fiber insulation; three largest models equipped with dual compressors, 10 and 15 hp models available with free air discharge plenum and with plenum steam coils; all models designed for duct steam coil use where desired and can be furnished with outdoor air inlets; bulletin "6022" available on request—*Dunham-Bush, Inc.,* 179 *South St., West Hartford* 10, *Conn.*



Electric Motors . . .

. . . feature integral tube-type air to air heat exchanger; for use in unfavorable environmental conditions, in sizes up to 2000 hp, standard enclosed construction or explosion-proof models; with capsule type split sleeve bearings and pressure lubricating systems with oil level indicators; bulletin "2400" available on request—*The Louis Allis Co., Dept. P, Milwaukee* 1, *Wis.*

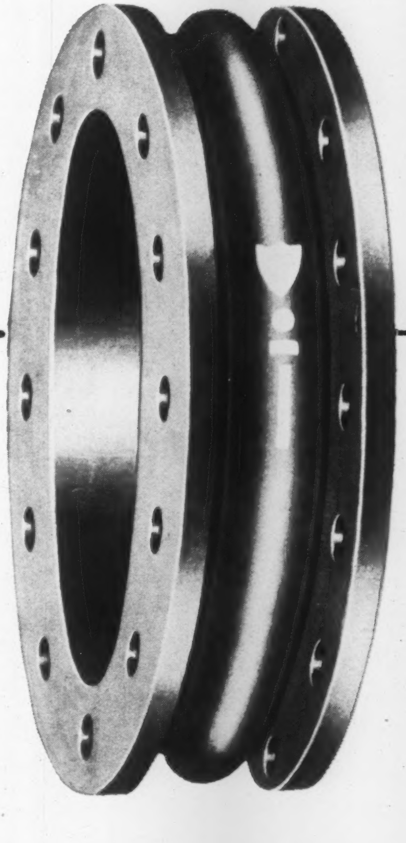
EXPANSION JOINTS

THEY STAY FLEXIBLE
when handling the most severe chemicals

"U. S." Expansion Joints of butyl rubber construction are recommended for handling certain chemicals.

Typical of these are:

ANILINE-R.T.
DIETHYL SEBACATE-R.T.
HYDROCHLORIC ACID (37%) UP TO 122° F
SODIUM HYDROXIDE (20-50%) UP TO 158° F
SODIUM HYPOCHLORITE (20%) UP TO 158° F
SULFURIC ACID (50%) AT R.T.



"U. S." Expansion Joints remain completely flexible at all times. Joints made of neoprene or natural rubber stiffen up, crack and fail when handling the above chemicals.

For the most severe service, specify "U.S." Expansion Joints lined with Teflon. These "U. S." Joints are ideal for handling most chemicals and solvents.

"U. S." Expansion Joints are in use in every kind of industry. Some of these joints have been on the job since 1924, the year "U.S." invented them! Long-lived, they *prolong the life* of equipment in pressure and vacuum systems.

• • •

When you think of rubber, think of your "U.S." Distributor. He's your best on-the-spot source of technical aid, quick delivery, and quality industrial rubber products.

Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

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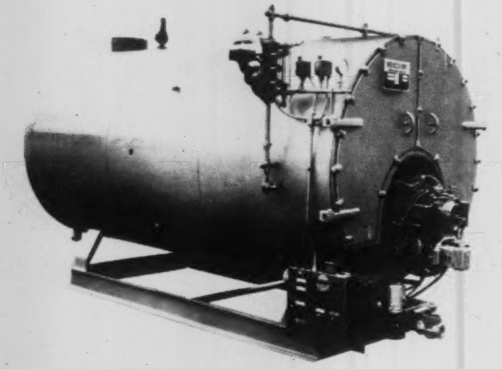
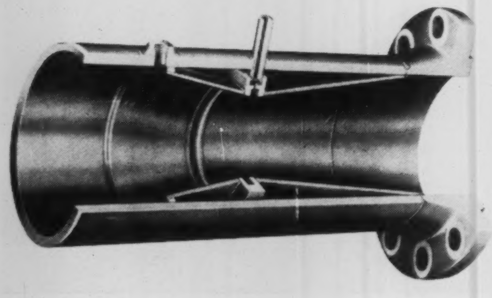


Packaged Boilers . . .

. . . in 10 to 125 hp models for light oil, natural gas, or combination gas-oil operation; of 3-pass design, with single motor for fan and pump, forced draft, operating and safety controls included in enclosed cabinet; low-fire start standard, full modulation on gas and oil available; catalog available on request—*Western Boiler Co., 47 Rousseau St., San Francisco 12, Calif.*

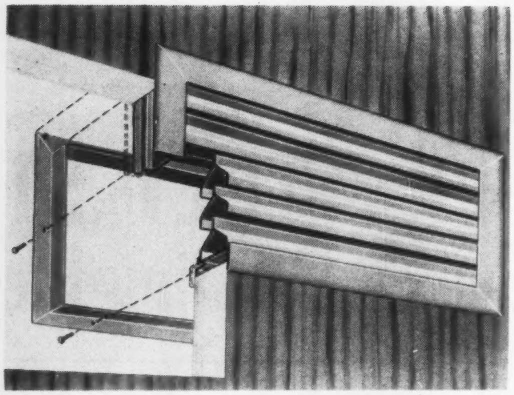
Indoor Cooling Towers . . .

. . . in 14 models with maximum nominal capacity of 90 tons; mechanical draft units feature centrifugal fans, hot-dipped galvanized casings, basins, fans, and scrolls, wide selection of air intake and discharge direction design, variety of inlet and suction connections; models are designed for quick disassembly if necessary; bulletin "AC-60" available on request—*The Marley Co., 222 W. Gregory Blvd., Kansas City 14, Mo.*



Flow Tubes . . .

. . . weldment type for metering liquids and gases at low or high pressures and temperatures available in variety of metals in rolled steel plate, castings, forgings, and bar stock form; line sizes from 1 to 120 in. are offered—*B-I-F Industries, Inc., 315 Harris Ave., Providence 1, R.I.*

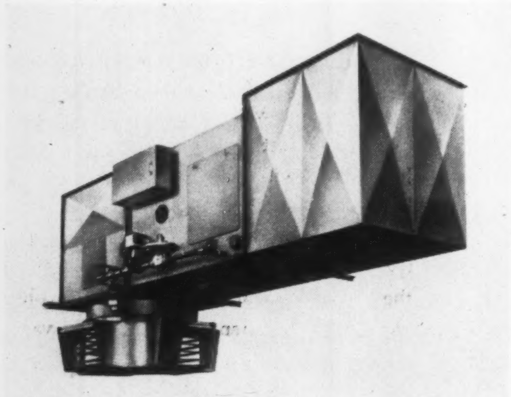


Door Louver . . .

. . . designed for commercial or institutional use where exceptional cleanliness is required can be removed for cleaning by detaching interior frame; with anodized or baked epoxy finishes, of extruded aluminum construction, in standard sizes; sight, light, or sound proof models also available—*Construction Specialties Inc., 55 Winans Ave., Cranford, N.J.*

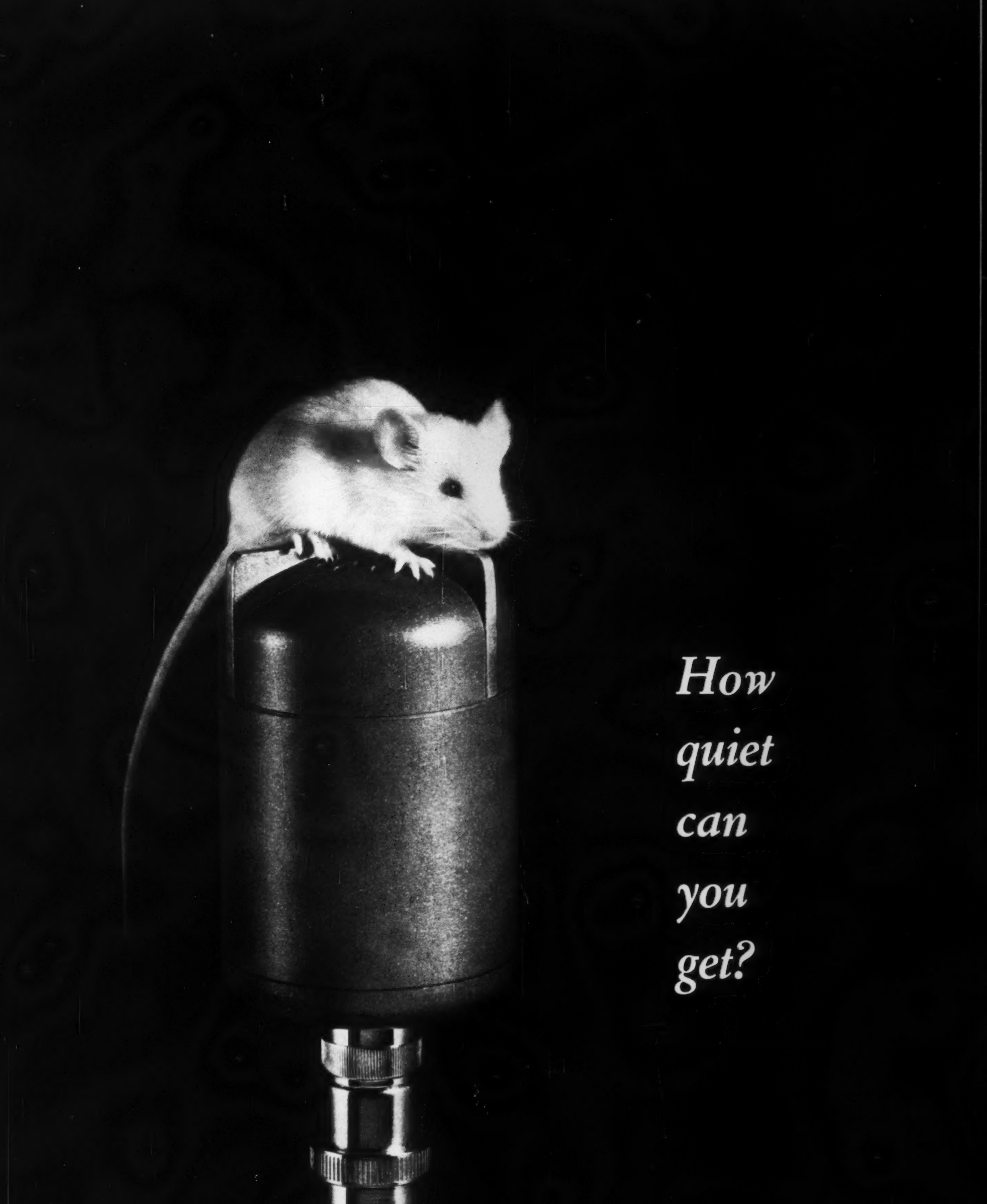
Thermocouples . . .

. . . for temperature measurements in excess of 3000 F; rhodium-iridium/iridium said to be useful for applications in vacuum or inert atmospheres up to 3600 F; tungsten-rhenium unit is for other than oxidizing atmospheres up to 4000 F with potential approaching 5000 F—*Minneapolis-Honeywell Regulator Co., 2753 4th Ave. S., Minneapolis 8, Minn.*



Outdoor Air Heaters . . .

. . . direct gas fired for makeup air heating, in five sizes from 15,000 to 50,000 cfm and 1.5 to 4.5 million Btu per hr operation on 220, 440, or 550 v a-c; high turndown ratio control allows minimum temperature rise down to 3.3 F; may be operated without heater for summer ventilation; design allows for roof or wall intake, with variety of discharge arrangements available, including revolving discharge unit—*L. J. Wing Mfg. Co., 140 Vreeland Mills Rd., Linden, N.J.*


How
quiet
can
you
get?

When you get ILG you can count

Even this supersensitive mike has to "listen" hard to pick up sound waves from this smooth, silent-running, self-cooled Ilg propeller fan.

Direct-connected rather than belt-driven motors and fans account for some of the silence—but only part of it. More important are Ilg fan design and the Ilg quality control checks that cut down noise and vibration on all Ilg electric fans and ventilators.

Careful dynamic balancing of all component parts, and electronic checks of motor and fan wheels—both before and after final assembly—make sure that quiet operation is as much a part

"Check-Out" Time. Every Ilg-built Type "Q" propeller fan wheel must pass rigid dynamic balancing "checks" before being direct-connected to Ilg-built *self-cooled,* 3-phase or permanent-split capacitor, single-phase motors. Ilg fans combine the cost operating advantages of *open type* motors with the protection of *totally enclosed* motors. New Catalog DB1-100 shows why. Why not send for it?

For fans built to satisfy your "specs"...

fans and ventilators,

on quiet operation

of each piece of Ilg equipment as the famous "One-Name-Plate" pledge of superior performance.

For further information, write for catalogs covering the complete line of Ilg electric ventilating equipment.

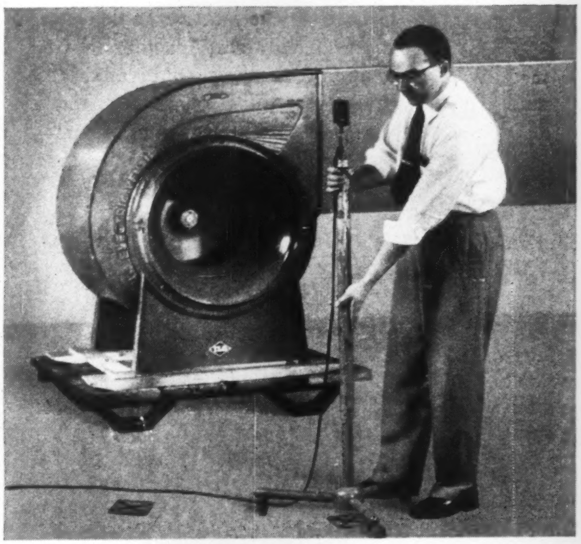
Each Ilg product shown carries the rating seal of the Air Moving and Conditioning Association Inc.

CERTIFIED RATINGS

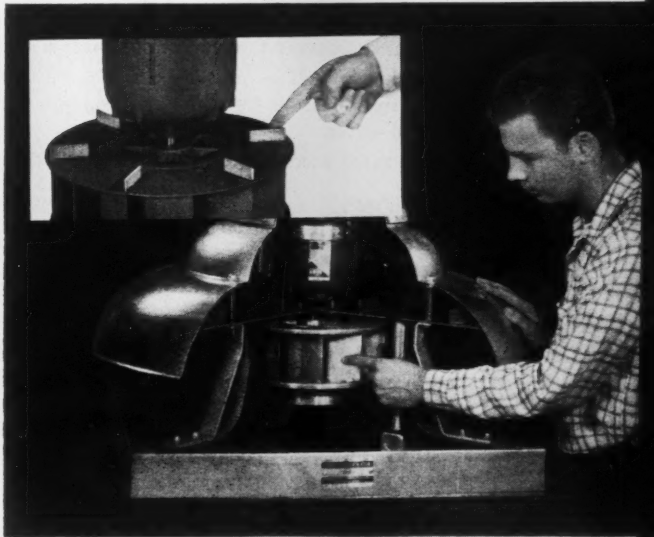
Certified Ratings are the result of tests made by the manufacturer in accordance with Standard Test Codes adopted by the Air Moving and Conditioning Association, Inc. Air Moving and Conditioning Association, Inc., is successor to Industrial Unit Heater Association, National Association of Fan Manufacturers, Inc., and Power Fan Manufacturers Association.

AUTHORIZED BY
AMCA
1957 AIR MOVING AND CONDITIONING ASSOCIATION, INC.

Your Choice of Util-A-Sets. Twelve sizes of this new self-contained, belt-driven centrifugal fan to choose from, ranging in capacities from 688 to 23,000 c.f.m. Both forward curved wheels and backward blade types available. Motor mounting on rubber isolation rails checks resonant noise. Full line of accessories. See Catalog 3401.



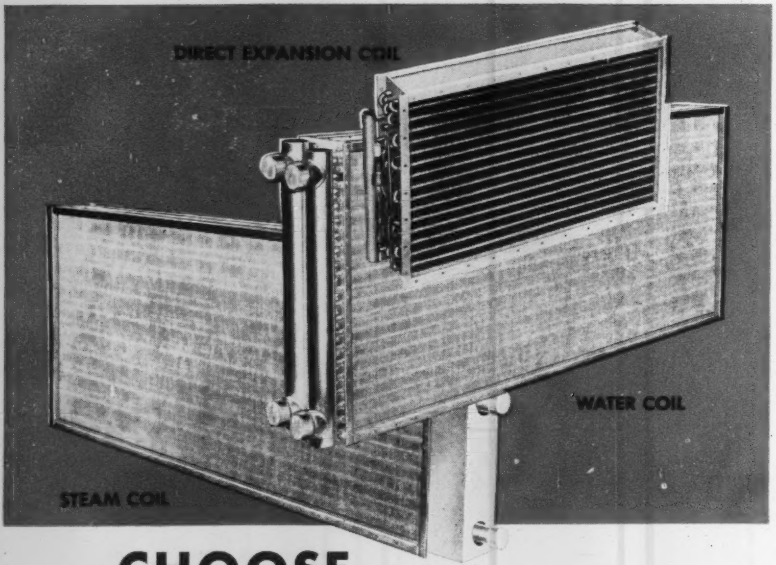
"***X Marks the Spot***" where the traveling mike is set to pick up sound waves from Ilg BC *airfoil* centrifugals. Backward curved airfoil blade design eliminates eddy currents and turbulence. Sound tests prove these fans can run at greater speed than older types—with *no increase in sound level, less drag and shock loss.* Standard construction suitable for Class I, II and III operation to 9" static pressure. See Catalog 257.



Pinpointing Patented Pressure Cooling. Ilg fanwheel backplate fins draw a steady stream of clean, cooling outside air through motor compartment . . . protect motor against build-up of heat from sun . . . increase motor life expectancy up to 4 times that of ordinary units. For further facts on Ilg L-CRF direct-connected *airfoil* centrifugal roof ventilators, Send for Catalog 2701. And for LSQ propeller fan roof ventilators, write for Catalog 2302.

specify ILG®

ILG ELECTRIC VENTILATING COMPANY
2826 N. Pulaski Road, Chicago 41, Illinois
Offices in 59 Principal Cities
Member of Air Moving and Conditioning Association Inc. (AMCA)



CHOOSE
BOHN
KNOWN-CAPACITY
COILS

ALL BOHN COILS are ruggedly built...

- Die-formed plate-type aluminum fins... from 4 to 14 per inch... with self-spacing collars completely covering the tubes. Permanent, tight, metal-to-metal fin-tube bond.
- Heavy-gauge casings die-formed from galvanized steel.
- Headers of heavy-wall seamless copper tube with heavy die-formed end caps. High pressure tested at 320 psig. minimum air pressure under warm water.
- Tested and rated according to ASRE-ASHAE standard 33-58.

IN ADDITION...

DIRECT EXPANSION COIL — Type DE, insures equal distribution of refrigerant with brass pressure-type distributors;

WATER COIL — in Types WH, WF, and WD, is drainable in every type;

STEAM COIL — in Types S, NFS, and NFO, has condensing tubes pitched in casing a minimum of ⅛" per foot of tube length, as well as orificed steam supply tubes, and coil tubes floating free within coil casing to prevent stress and strain on tubes and joints... maximum operating pressure 200 psig. at 400° F.

We have some territories still open for Manufacturers Representatives who are active in the heating and air conditioning fields. Write today to Sales Manager, Heating and Cooling Coil Department, at the address below.

BOHN *Buy the known line... the BOHN line*
Aluminum & Brass Corporation
Danville Division • Danville, Illinois

EQUIPMENT DEVELOPMENTS

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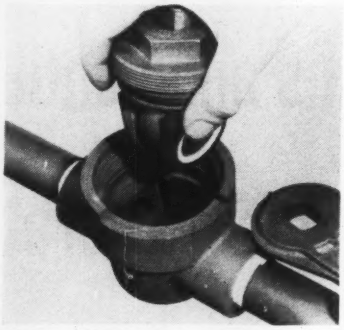
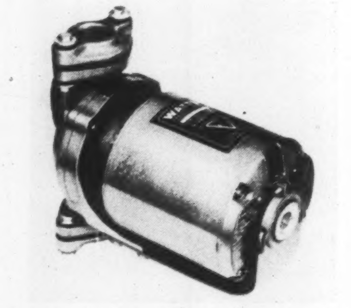


Ball Valves . . .

. . . of UPVC for operating temperatures to 150 F and chorinated polyether for service to 250 F, ½ through 3 in. nominal pipe sizes, threaded or socket type; feature top-entry design which allows ball and stem and seating inserts to be lifted out via screwed-on bonnet—*Tube Turns Plastics, Inc., 224 E. Broadway, Louisville 1, Ky.*

Corrosion Inhibitor . . .

. . . filming amine in flake form, said to be completely active as delivered, with no additives; alkaline in feed solution, may be used in mild steel equipment; dispersible in water, with 115 to 120 F melting point — *Dearborn Chemical Co., Merchandise Mart, Chicago 54, Ill.*



Water Circulator . . .

. . . has pump impeller attached directly to 1/12 hp motor shaft for minimum maintenance needs; with ¾, 1, 1-¼, and 1-½ in. flanges; said to be suitable for small boiler application; folder "F-1000" available upon request—*Watts Regulator Co., 10 Embankment St., Lawrence, Mass.*

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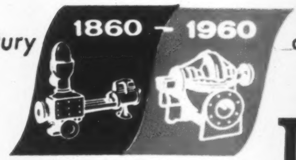
Today, you can get a modern, dependable Ingersoll-Rand pump to meet the requirements for air-conditioning installations of any size. In small homes, large homes, hotels, buildings and institutions—regardless of tonnage or head—I-R pumps have proven their economy through low-cost, trouble-free operation. Check with Ingersoll-Rand today. See how easy it is to get a pump that meets your needs exactly!



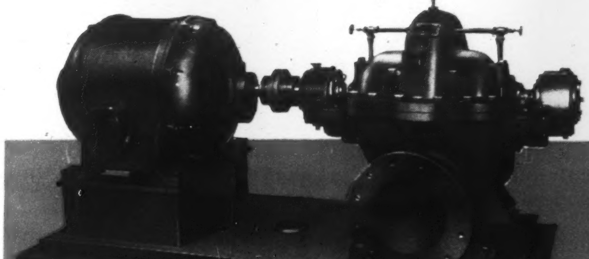
a century 1860 – 1960 of pump progress

from the leading manufacturer . . .

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

gpm to 4000
heads to 1100 ft



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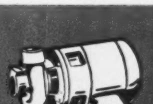
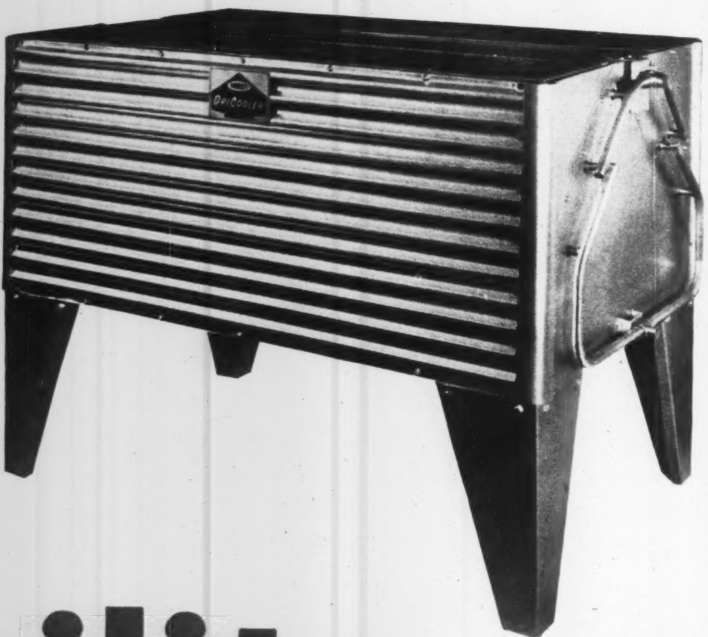
OTHER I-R PUMPS FOR
AIR-CONDITIONING SERVICE



"K" Line
Motorpumps

"RV" Line
Motorpumps

Cradle-Mounted
Pumps



ability stands out in

New MARLEY *Series B DriCooler®

CONDENSERS

cap **ability**

Tops in Heat Transfer: Exclusive vertical, forced-draft design moves more pounds of air per cubic foot. Diagonally mounted coils form plenum that diffuses air over all coil surfaces. Entire coil area is functional—no "dead" spots, no recirculation.

adapt **ability**

23 models: One will pin-point any job of 10 to 140 tons nominal capacity. Modular coils permit broad flexibilty for multi-circuit service. Vertical discharge means unrestricted choice of location regardless of wind direction or obstruction.

dur **ability**

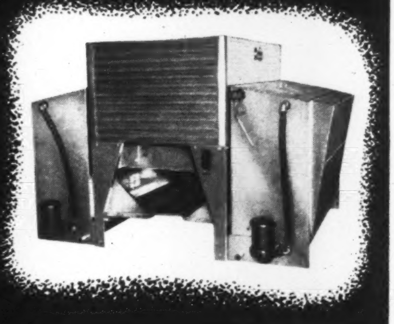
Rugged, Rigid Construction: Coils and mechanical equipment are mounted on heavy welded and bolted truss-type steel frame—all hot dip galvanized. Support members are sturdy, broad angles that add materially to long vibration-free service.

compat **ability**

Appearance Is Plus Factor: New design uses newest materials. Casing of embossed, corrugated aluminum panels, precision-fitted corner rolls and manifold covers combine with low over-all height to achieve effective harmony with modern structural design.

THE MARLEY COMPANY, KANSAS CITY 14, MISSOURI

*U. S. and Foreign Patents Pending



...and complete year 'round controlability

when equipped with
New Marley originated

ADB PRECOOLER*

that levels high dry bulb peaks and excessive pressures by adiabatically reducing incoming air temperature with no spray on coils. Permits economical selection of original equipment; adds capacity for increased or unanticipated condenser load. DriCooler-PreCooler combination efficiently converts water-cooled systems to air-cooled.

... and

DRICOOLER DAMPER CONTROL SYSTEM*

the simplest, most efficient method of maintaining uniform pressure during low dry bulb periods. Automatically controls single or multi-circuit services. No added refrigerant charge; no oversized receiver.

Get the complete story on Series B DriCoolers; learn the added utility and economy of these air-cooled condensers.

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The Marley Company
Kansas City 14, Missouri

☐ *Send me complete information on DriCoolers with year 'round control.*

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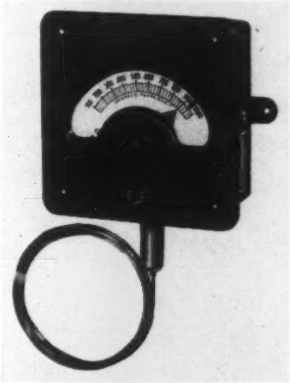
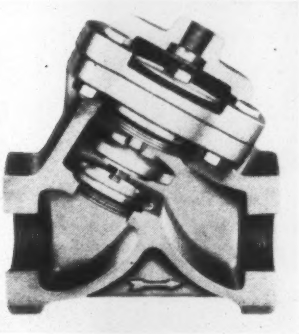
Company________________
Address________________



Temperature Control . . .

. . . of remote bulb, high temperature indicating design for 100 to 1000 F ranges or other range spans on request, in three models with three sensing bulb types; unit may be set to control anywhere within scale limits; normally closed, normally open, and double throw switch actions available; rated at 15 or 20 amp, 115 to 230 v a-c—*United Electric Co., 85 School St., Watertown 72, Mass.*

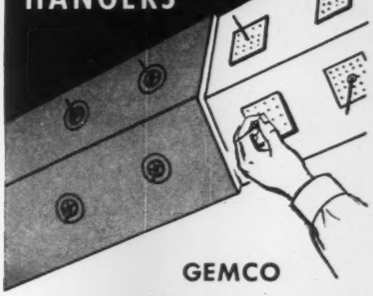


Diaphragm Valves . . .

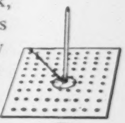
. . . in ¾ to 2½ in. sizes operate directly from line pressure without springs or auxiliary forces; line pressure applied above diaphragm via ¼ in. line and control valve forces diaphragm with attached stem and disc to seat because area of line pressure on diaphragm is larger than that on disc; all working parts can be replaced without removing valve from line; with screw type cast iron bodies, larger flanged sizes to come —*AquaMatic Inc., 2412 Grant Ave., Rockford, Ill.*

**SAVE TIME—
SAVE MONEY**

with these dependable INSULATION HANGERS

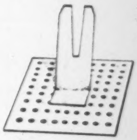


**GEMCO
Spindle Hangers and
W-A Self-Locking Washers**



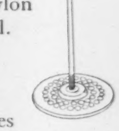
Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed . . . with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.

GEMCO Pronged Hangers



Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1$\frac{3}{16}$" to 6⅞") bend over to hold insulation firmly in place.

TUFF-WELD Nylon Hangers



Two-piece hangers . . . with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.

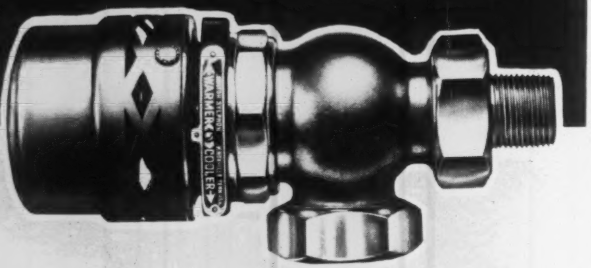
TUFF-BOND Quik-Set Adhesive (for smooth or slightly irregular surfaces) and Improved General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 28, ILLINOIS

Lowest Cost *Individualized* Control

. . . for one office or a 400-room hotel!

ROBERTSHAW AUTOMATIC RADIATOR VALVES



No. 885 for exposed radiators

The most flexible, lowest-cost answer yet to the need for *individualized* control of new or existing heating plants!

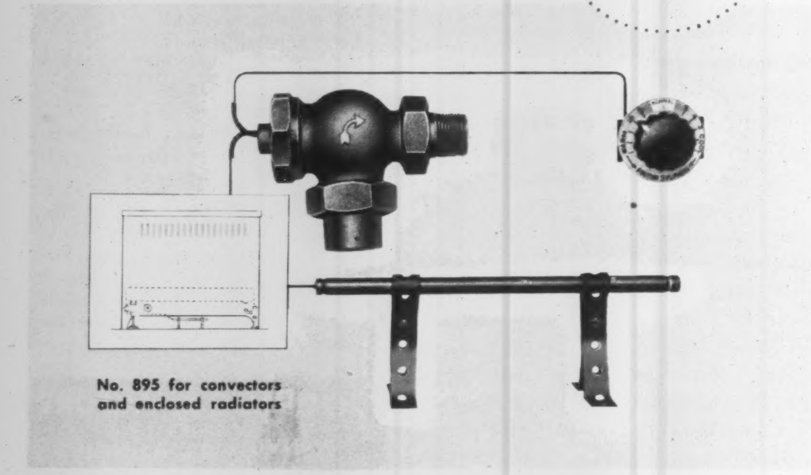
Replace ordinary radiator valves with these Robertshaw Automatics . . . design them into your largest, most modern new installation . . . and you have perfect control combined with outstanding economy.

Actuated by sensitive Robertshaw seamless metal bellows, these precision valves are easily adjusted to individual needs . . . and can be locked to retain their setting.

- For steam or hot water service
- Positive response to temperature changes
- Self-contained, self-operated
- No packing to wear out
- Low initial cost; no upkeep

Complete Specifications in Catalog LH-B, **Fulton Sylphon Division, Robertshaw-Fulton Controls Company, Knoxville 1, Tenn.**

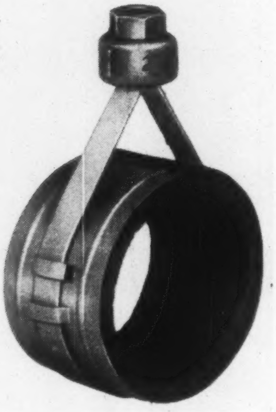
Robertshaw® MR. CONTROLS



No. 895 for convectors and enclosed radiators

EQUIPMENT DEVELOPMENTS

Continued

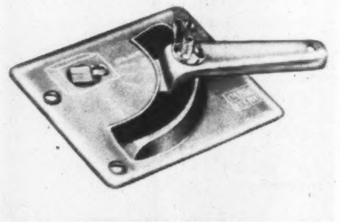


Pipe Hangers . . .

. . .with integral sound isolators in standard pipe and tubing sizes from 3/8 to 6 in.; isolator consists of factory installed sheet metal cover with felt liner, also available with stainless steel or aluminum covers—*Elcen Metal Products Co., 9333 King St., Franklin Park, Ill.*

Chemical Additives . . .

. . .for green algae and slime bacteria control in evaporative condensers and cooling towers; pellet type releases chlorine in water over period of several hours; liquid type forms film on metal and wood surfaces for extended control—*Calgon Co., Hagan Center, Pittsburgh 30, Pa.*



Damper Regulator . . .

. . .rectangular, for dampers up to 20 in., with 3/8 in. control shaft, easy to read indicator dial; manufacturer states unique wedging and locking action virtually eliminates damper rattles and minimizes air leakage—*Duro-Dyne Corp., Route 110, Farmingdale, L.I., N.Y.*

53 FRICK REFRIGERATING AND AIR CONDITIONING UNITS SERVE ST. LOUIS MEDICAL CENTER

Frick Equipment Used Exclusively For Original Equipment Plus 37 Additional Orders In Past 16 Years.

The Barnes Hospital-Washington University Medical Center in St. Louis is a good example of the dependability and versatility of Frick refrigeration and air conditioning equipment. Since 1944, when the first unit of Frick equipment was installed, 37 repeat orders have raised the number of Frick units to 53.

Today, 13 "ECLIPSE" compressors, 29 low pressure units, and 11 unit air conditioners are in service.

The medical center facilities themselves have expanded to include eight hospitals with nearly a thousand beds, schools of nursing, dentistry, and occupational therapy . . . clinics, laboratories, lecture rooms, and libraries.

All of the air conditioned operating rooms are provided with 100% fresh air which is filtered electrically. The main kitchens, cafeteria and dining rooms are all air conditioned with Frick equipment. All cooler and freezer units are automatically defrosted. Some units maintain temperatures from 0° to 100° F., with varying humidity control.

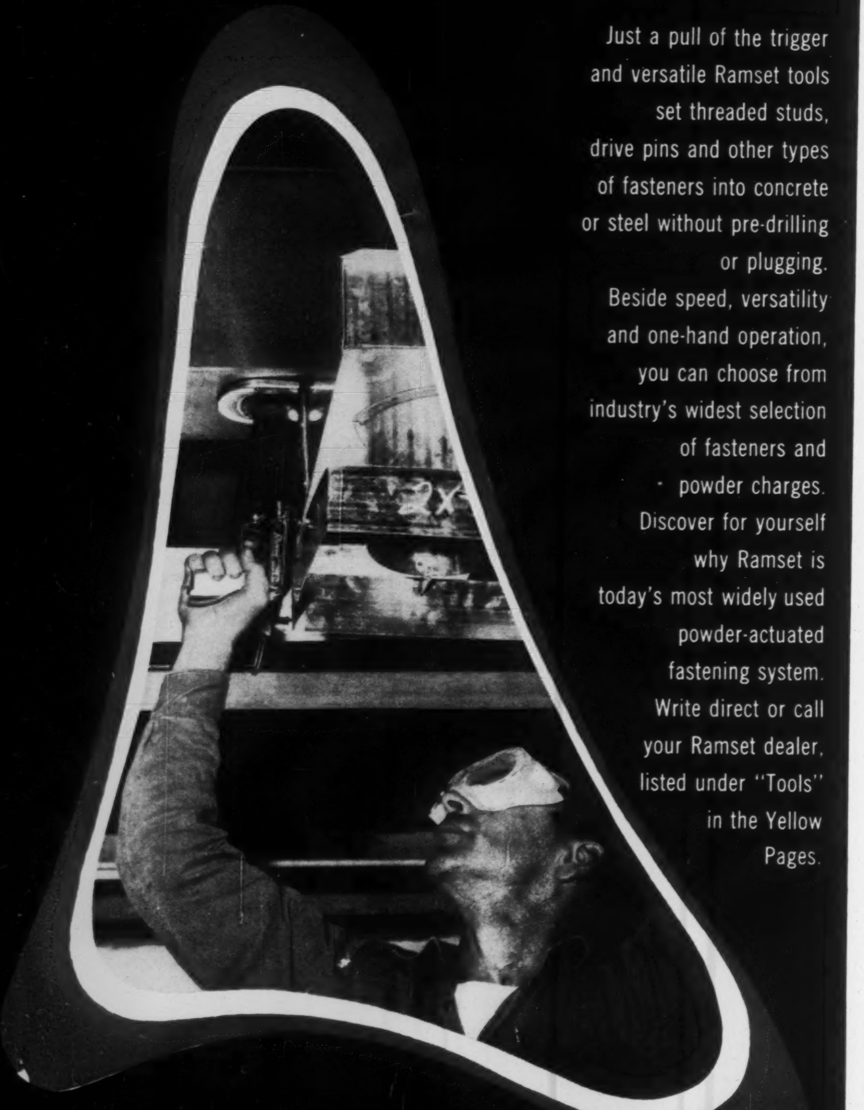
In some special research projects, dual refrigeration equipment with indicating red lights has been installed.

If your interest is industrial or institutional refrigeration or air conditioning, a Frick engineer will be happy to discuss it with you at no obligation.

FRICK COMPANY
Waynesboro, Pennsylvania

TRADE FRICK MARK ®

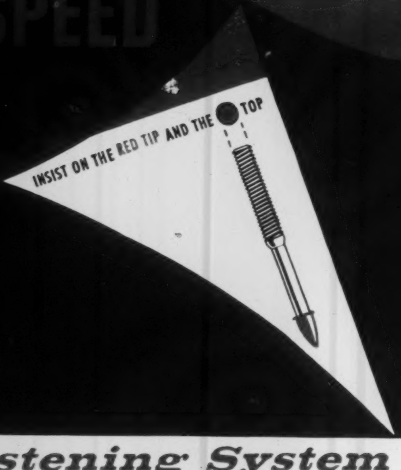
°F	
80	Summer air conditioning
75	Cooled swimming pools
70	Winter air conditioning
65	Chocolate dipping rooms
60	Banana ripening rooms
55	Cold water for processing
50	Cold drinking water
45	Smoked meat storage
41	Cold rubber processing
36	Fresh food storage
35	Milk storage
34	Water for carbonation
30	Long-term apple storage
28	Seawater in fish-boat holds
25	Hide storage cellars
23	Fresh-frozen ice cream
20	Moth-killing fur storages
15	Brine for ice skating rinks
10	Freezing Shell-Ice
5	Ice cream cabinets
0	Frozen-food display cases
− 5	Long-term butter storage
− 10	Frozen pork and beef stg
− 15	Optimum frozen-food stg.
− 20	Commercial quick-freezers
− 22	Refrig.-12 at atmos. press.
− 28	Ammonia at atmos. press.
− 30	Hardening ice cream
− 40	Storage of aluminum rivets
− 44	Propane liquefies
− 50	Quick-freezing tunnels
− 54	Propylene liquefies
− 90	Testing rockets & fuels
− 100	Research laboratories
− 109	Dry ice temperature
− 128	Ethane liquefies
− 140	Hardening cast aluminum
− 155	Ethylene liquefies.
− 258	Methane liquefies
− 297	Oxygen liquefies
− 318	Liquid air temperature
− 320	Liquid nitrogen temp.
− 411	Neon liquefies
− 423	Hydrogen liquefies
− 452	Helium liquefies
− 460	Absolute zero



leading contractors use Ramset

Just a pull of the trigger and versatile Ramset tools set threaded studs, drive pins and other types of fasteners into concrete or steel without pre-drilling or plugging. Beside speed, versatility and one-hand operation, you can choose from industry's widest selection of fasteners and powder charges. Discover for yourself why Ramset is today's most widely used powder-actuated fastening system. Write direct or call your Ramset dealer, listed under "Tools" in the Yellow Pages.

WHERE SPEED IS VITAL

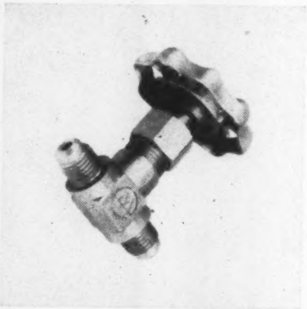

INSIST ON THE RED TIP AND THE ● TOP

Ramset® Fastening System

OLIN MATHIESON CHEMICAL CORP. • WINCHESTER-WESTERN DIV. • 291-F WINCHESTER AVE. • NEW HAVEN 4, CONN.

EQUIPMENT DEVELOPMENTS

Continued

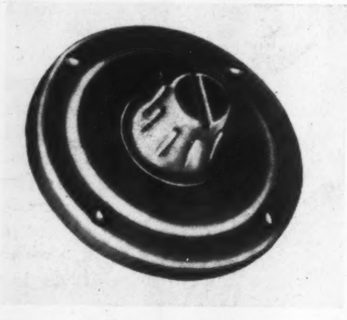


General Purpose Valves

... designed for charging, purging, other industrial purposes, suitable for panel mounting, with forged brass bodies, "easy-grip" handles, composition packing and seats; provide positive leak-proof shut-off without stress, according to manufacturer—*Madden Brass Products Co., Aurora, Ill.*

Masonry Drills . . .

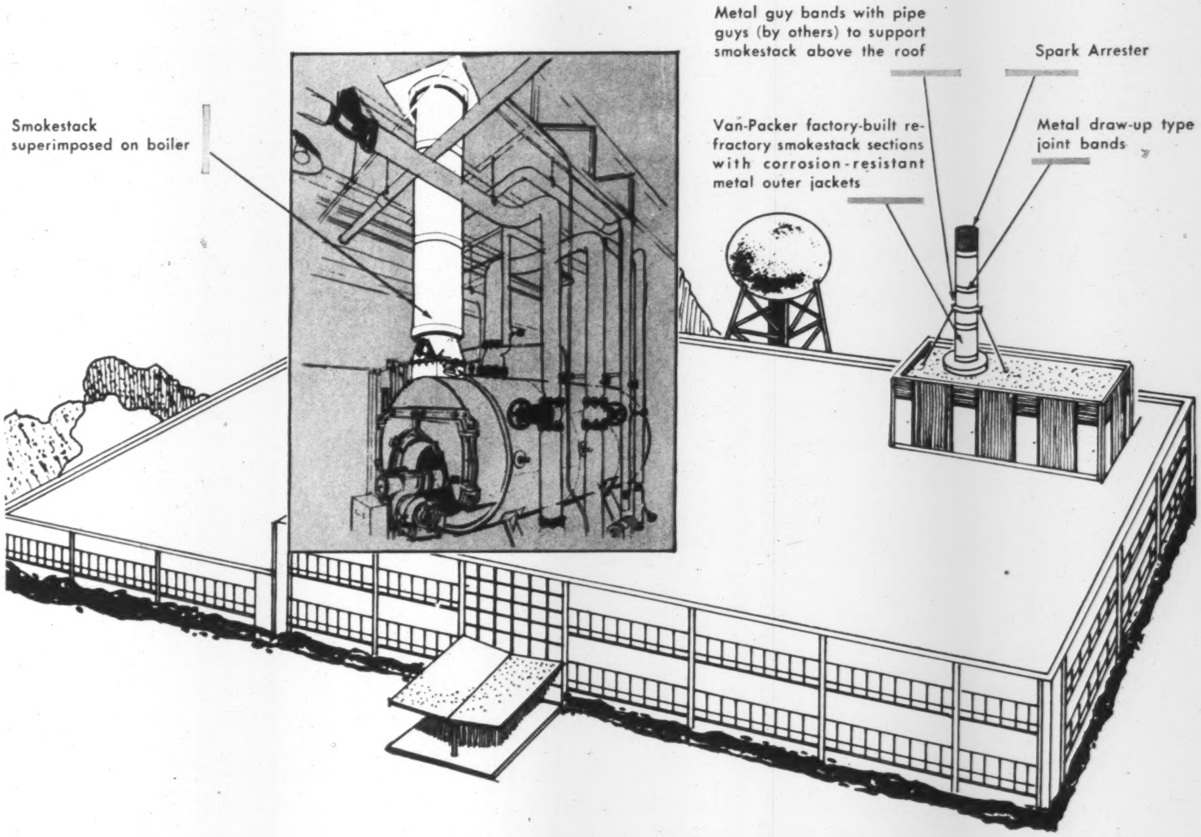
... carbide tipped spiral design in .132 to 1.535 in. diameters, lengths from 2½ to 10 in. (standard sizes ⅛ to 1½ in.); carbide tips are brazed in, pivot points are designed to direct full force against center of drill tip for faster drilling, less "walk"—*The Rawlplug Co., Inc., 200 Petersville Rd., New Rochelle, N.Y.*



Damper Regulator . . .

... for use in exposed areas where appearances are important, is hand operated without tools; shows position of damper at all times; release of operating knob locks damper in position; plastic—*Duro-Dyne Corp., Route 110, Farmingdale, N.Y.*

Flintkote•Van-Packer factory-built refractory smokestack outlasts steel stacks, costs no more


Smokestack superimposed on boiler
Metal guy bands with pipe guys (by others) to support smokestack above the roof
Spark Arrester
Van-Packer factory-built refractory smokestack sections with corrosion-resistant metal outer jackets
Metal draw-up type joint bands

The Van-Packer Model HT Smokestack is the *only* industrial stack listed under the Factory Inspection and Label Service Program of Underwriters' Laboratories, Inc. It handles boilers, furnaces and incinerators. Van-Packer Smokestacks consist of factory-built 3-foot refractory sections with corrosion-resistant metal jacket and fittings. They cost about the same as steel stacks for comparable applications, yet last far longer. They require no painting or maintenance. Van-Packer Smokestacks are available in eight inner diameters: 10", 12", 15", 18", 21", 24", 30", and 36". See "Smoke Stacks" in the Yellow Pages for your nearest Van-Packer Distributor/Erector, or send coupon for full information.

FLINTKOTE

VAN-PACKER®

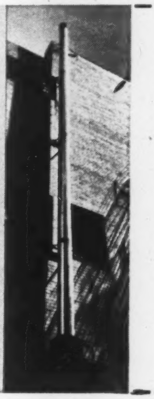
Division of The Flintkote Company

Manufacturers of Diversified Products for Home and Industry

30 Rockefeller Plaza, New York 20, N. Y.
Phone: PLaza 7-5500

In the West:
Pioneer Division, The Flintkote Company
P. O. Box 2218, Terminal Annex, Los Angeles, Calif.

In Toronto, Ontario:
The Flintkote Company of Canada, Ltd.



The Flintkote Company
Van-Packer Division
30 Rockefeller Plaza
New York 20, New York

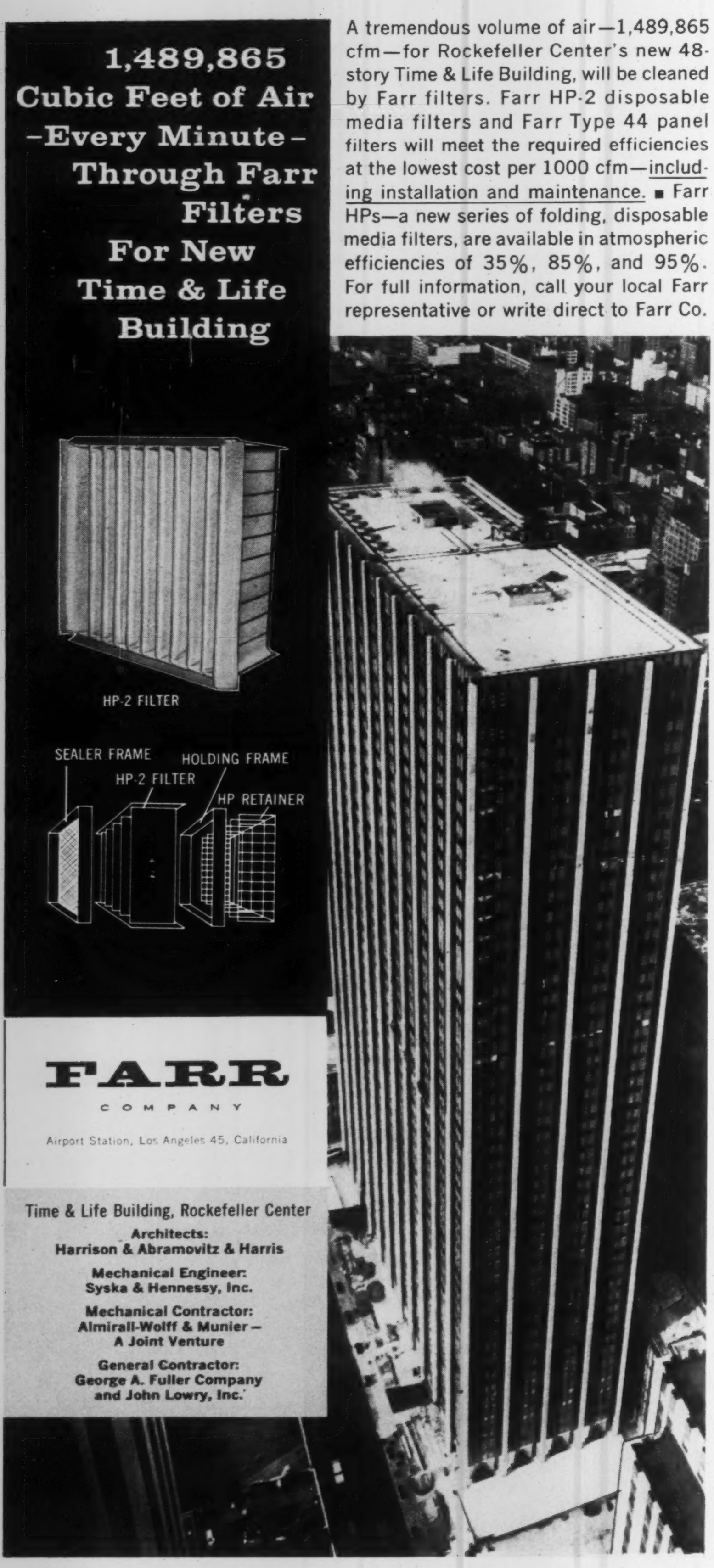
Please send Bulletin IS-40 containing complete information and engineering data on Van-Packer Smokestacks.

My name ________________

Firm ________________

Address ________________

City ________ Zone ____ State ____



1,489,865 Cubic Feet of Air -Every Minute- Through Farr Filters For New Time & Life Building

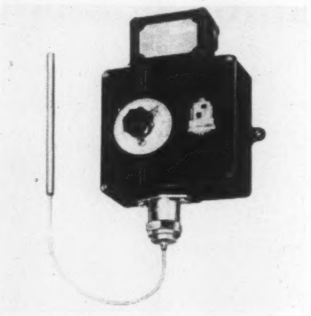
A tremendous volume of air—1,489,865 cfm—for Rockefeller Center's new 48-story Time & Life Building, will be cleaned by Farr filters. Farr HP-2 disposable media filters and Farr Type 44 panel filters will meet the required efficiencies at the lowest cost per 1000 cfm—including installation and maintenance. ■ Farr HPs—a new series of folding, disposable media filters, are available in atmospheric efficiencies of 35%, 85%, and 95%. For full information, call your local Farr representative or write direct to Farr Co.

FARR COMPANY
Airport Station, Los Angeles 45, California

Time & Life Building, Rockefeller Center
Architects:
Harrison & Abramovitz & Harris
Mechanical Engineer:
Syska & Hennessy, Inc.
Mechanical Contractor:
Almirall-Wolff & Munier — A Joint Venture
General Contractor:
George A. Fuller Company and John Lowry, Inc.

EQUIPMENT DEVELOPMENTS

Continued

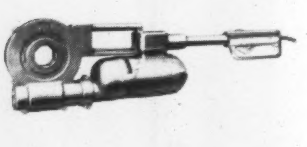


Temperature Control . . .

. . . non-indicating, explosion proof for use in hazardous locations on heating and cooling units, incorporates snap-action switch actuated by expansion and contraction of mercury against diaphragm through lever mechanism; features interchangeable elements for field replacement; for −30 to 1100 F temperatures with 10 ranges—*The Partlow Corp., 534 Campion Rd., New Hartford, N.Y.*

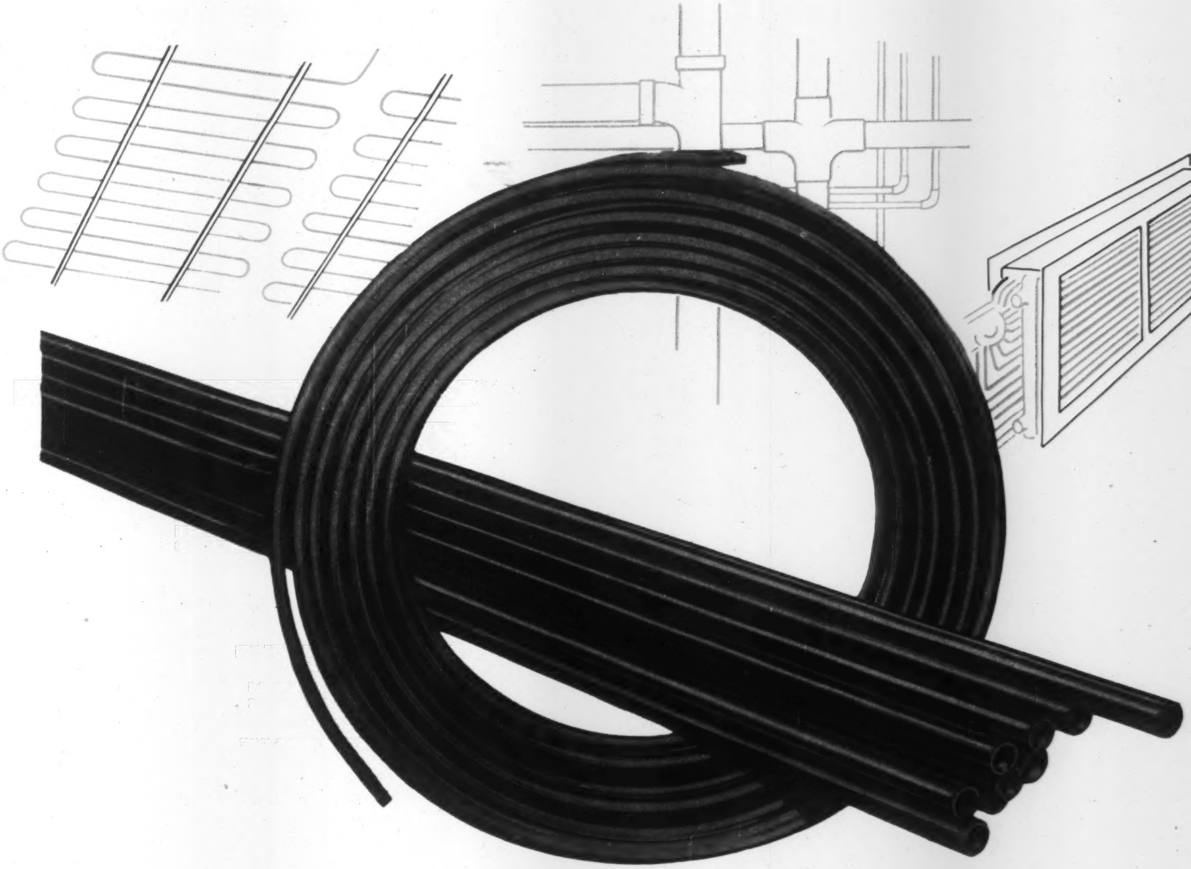
Welding Torch . . .

. . . for arc welding equipment said to provide extreme heat for difficult jobs without exerting pressure; available in a-c model with two 10 ft. cables, 3/8 and ¼ in. carbons or d-c model with 10 ft cables, ¼, 5/16, and ½ in. carbons—*Metal & Thermit Corp., General Offices, Rahway, N.J.*



Pipe Threader . . .

. . . powered and portable for threading ¼ to 4 in. pipe operates on ¾ hp electric motor for 26 rpm geared tool output; fitted with adaptor for larger pipe sizes; housing and motor mounts of aluminum alloy; also adaptable for use with auger or portable winch—*Albertson & Co., Inc., Sioux City, Ia.*



When predictable performance is imperative...

COPPER TUBE

HUSSEY COPPER AND BRASS TUBING & PIPE

Copper All Purpose Tube

Copper Water Tube (Types K, L, M)

Copper Refrigeration Tube (Dehydrated and Sealed Ends)

Copper Pipe

Brass Tube (also square, rectangular, hexagon)

Red Brass Pipe

There is no substitute for a material with proven service characteristics. Consider these unique advantages of COPPER TUBE: *conductivity* . . . highest heat transfer of all commercial metals; *durability* . . . unequalled corrosion resistance, even in underground installations; *flexibility* . . . forms readily to any design, regardless of complexity.

Hussey Copper Tube is available in a full range of sizes, tempers and wall thicknesses—all quality controlled to meet your most critical needs.

MADE IN U.S.A
TO THE STANDARDS
OF AMERICAN INDUSTRY
★★★★★★★

COPPER
HUSSEY
BRASS

C. G. HUSSEY & COMPANY
Division of Copper Range Co.

Rolling Mills and General Offices
PITTSBURGH 19, PENNSYLVANIA

7 Convenient Warehouses

PITTSBURGH CLEVELAND NEW YORK CHICAGO
ST. LOUIS PHILADELPHIA CINCINNATI

new redesigned

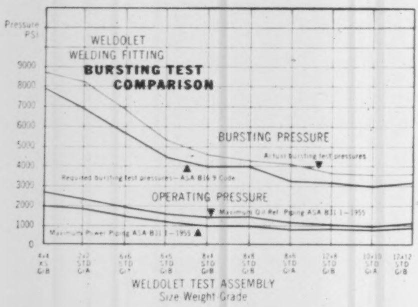
BONNEY WELDOLETS

for reinforced branch connections on carbon steel and alloy pipe

Welding fittings manufactured and tested in accordance with ASA B16.9 and ASA B31.1

clean-cut bevel with exactly 1/16" land
bore machined with a watchmaker's precision and finish
reduced angle of bevel ... weld volume cut almost 50%
weld line clearly defined ... no more errors about "how much to weld"
skirt taper redesigned for improved stress distribution

RESULTS? OVER 4½ TIMES MAXIMUM OPERATING PRESSURE



BONNEY

WELDOLETS®
THREDOLETS®
SOCKOLETS®
ELBOLETS®
BRAZOLETS®
SWEEPOLETS®

CARBON STEEL
STAINLESS
ALLOY
for all services

For high strength and low-total installed cost compare with . . . other reinforced branch construction . . . unreinforced branch construction . . . and welding tee construction. Then specify and use Weldolet fittings for all full size and reducing branch connections.

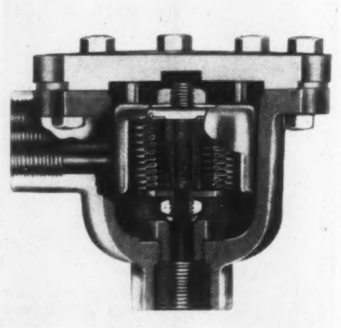
BONNEY FORGE AND TOOL WORKS

ALLENTOWN, PENNSYLVANIA

OSTER
OSTER
1-4
10

Tubing Cleaner . . .

. . . for cleaning fitting ID and deburring of tubing OD in sizes of ½ through 4 in.; equipped with six oscillating spindles for work on as many size fittings without changing brushes; rotating steel brush is side mounted for tubing cleaning and incorporates rotating file for deburring; reaming tool for tubing up to 2 in. also available—*The Oster Mfg. Co., 1340 E. 289th St., Wickliffe, O.*



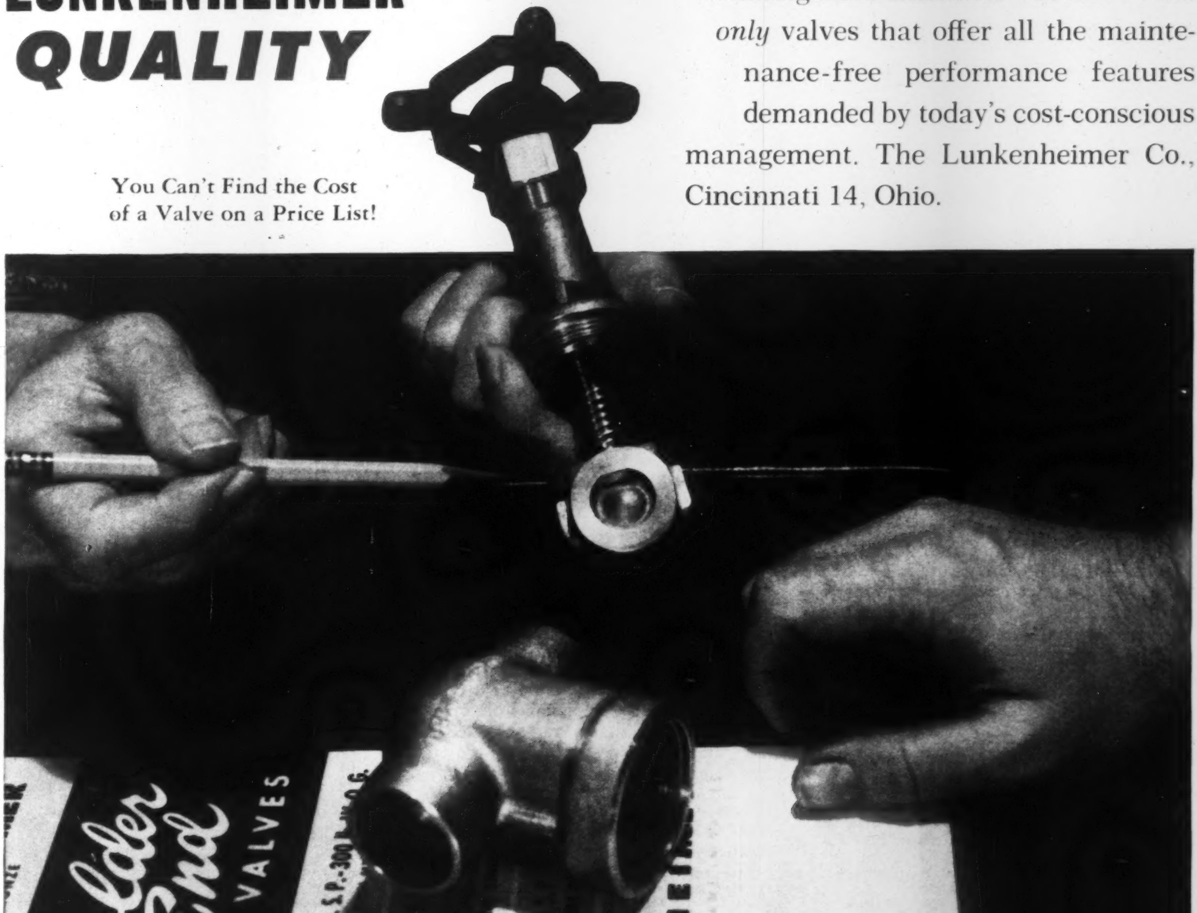
Steam Trap . . .

. . . thermostatic, of double bellows design for non-cycling modulated operation; design advantages claimed are proportionately greater orifice size for higher capacity, positive closing to prevent weeping, improved heat recovery of process equipment, non-freezing; single size trap will operate from 1 to 150 psi without orifice change, according to manufacturer — *The C. E. Squires Co., 18502 Syracuse Ave., Cleveland 10, O.*

NOW IS THE TIME TO CAPITALIZE ON THE BIGGEST SINGLE ADVANTAGE OF LUNKENHEIMER— *QUALITY*

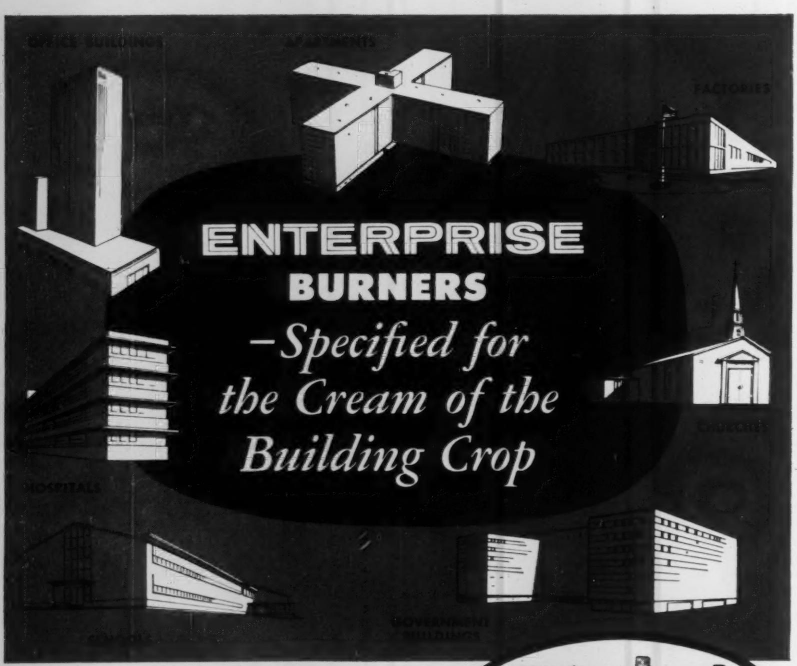
The demand for *quality* valves—valves that keep going month-after-month without maintenance—is at an all-time high. The reason? Top management, middle management—everyone who has a stake in operating efficiency—recognizes that repair and downtime costs gobble up profits at an alarming rate. The *one* sound solution to this problem is *quality* valves. To provide this solution, more and more architects, engineers and contractors are specifying and installing Lunkenheimer Valves . . . the *only* valves that offer all the maintenance-free performance features demanded by today's cost-conscious management. The Lunkenheimer Co., Cincinnati 14, Ohio.

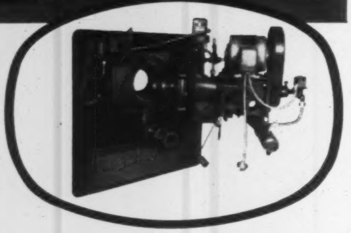
You Can't Find the Cost
of a Valve on a Price List!



LUNKENHEIMER
QUALITY

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES





A History of 30 Years' Leadership Backs Your Choice of Enterprise

First in Burner Design

Scores of original burner developments were Enterprise "firsts." V-Belt Drive, used exclusively on all Enterprise Burners since 1938, introduced new flexibility, efficiency and economy to horizontal rotary burner operation. The remarkable Enterprise "Measured-Rate" Metering Pump brought an end to problems of oil flow due to varying oil temperatures and viscosity. These and other contributions to better burner service reflect the efforts of a continuing program of product development at Enterprise.

The Quality-Built Burner Line

Only the finest of materials are used in manufacturing Enterprise Burners. Every phase of production is precisely controlled by expert craftsmen to maintain highest quality standards. No wonder Enterprise Burners are built better, cost so little to operate and maintain, insure long, efficient, trouble-free service.

Only Fully Qualified Distributors and Dealers Serve You

An unusually high percentage of Enterprise Distributors and Dealers have been selling and installing Enterprise Burners for from 10 to 30 years. Enterprise works closely with these distributors, offering complete engineering service on such things as combustion chamber design, correct piping arrangements and electrical diagrams—to assure you of the most efficient operation of your Enterprise Burner.

These are the plus factors you enjoy when you specify Enterprise—first choice in burners where quality comes first.

Available in sizes from 4 to 200 gallons per hour. Listed by Underwriters' Laboratories, Inc., U.S.A., Underwriters' Laboratories of Canada, and approved by the Canadian Standards Association.

SEND FOR *NEW FREE*, fully illustrated specification sheets on Enterprise Industrial, Automatic, and Combination Gas-Oil Burners.

—The choice of Heating Experts

..ENTERPRISE..................
dependable **BURNERS**

ENTERPRISE ENGINE & MACHINERY CO.
Adel Division, General Metals Corporation
1444 Washington Ave., Huntington 1, W. Va.

EQUIPMENT DEVELOPMENTS
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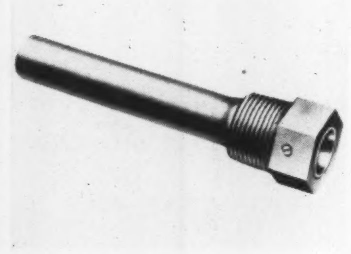
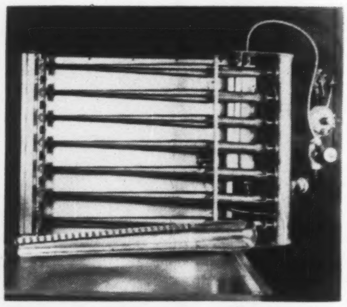


Thermal Well . . .

. . . for pressures to 3000 psi at 600 F or 2000 psi at 700 F, in three styles: coupling head, hex head, or with moisture-sealed cover; all types constructed of stainless steel with welded junctions; literature available upon request — *Fenwal Inc., Pleasant St., Ashland, Mass.*

Machinery Mount . . .

. . . for precision applications, said to maintain level within 0.0005 in. per ft of length; operates from plant air supply, compensates for changes in loading, variations in floor level, external and internal thermal changes; pneumatic loading provides vibration and shock isolation, according to manufacturer — *Barry Controls, 700 Pleasant St., Watertown, Mass.*



Duct Heaters . . .

. . . gas fired, with stainless steel burner for use with gases ranging in heating values from 500 to 3200 Btu per cu ft; burner incorporates straight-line shape, slim profile, elongated port section for high secondary air entrainment, minimum turbulence, according to manufacturer—*Reznor Mfg. Co., 51 Union St., Mercer 8, Pa.*

Model of the new Hall of Justice now under construction in San Francisco, California. Completion of building is scheduled for 1961.

Phelps Dodge Copper Tube

Specified for the Plumbing Lines of San Francisco's New Hall of Justice!

Within the superb new Hall of Justice being constructed for the City and County of San Francisco will be over a quarter million pounds of Phelps Dodge copper water and DWV tube serving as plumbing lines for this completely modern structure.

The new Hall of Justice will bring together under one roof all the functions of the city and county related to law enforcement. Among the novel features will be a heliport located on the roof.

General contractors for the project are the M & K Construction Corporation, while J. B. Nettles & Co., Inc. is the mechanical contractor and G-M-Simonson, the electrical and mechanical engineers. Project architects under the direction of Bureau of Architecture, Department of Public Works, are Weihe, Frock & Kruse, together with the City Architect, Charles W. Griffith. The plumbing distributor is P. E. O'Hair and Co. of San Francisco.

* * *

From the Golden Gate to Gotham, plumbing contractors know they can rely on the quality of Phelps Dodge famous "Mine-to-Market" tube and pipe. That's why so many of them specify Phelps Dodge for every kind of installation!

See your Phelps Dodge distributor!

PHELPS DODGE COPPER PRODUCTS
CORPORATION
New York, N.Y. • Los Angeles, Calif.

P
D

Revolutionary Tool!

New Tee Turner cold draws reducing tees —no fittings necessary!

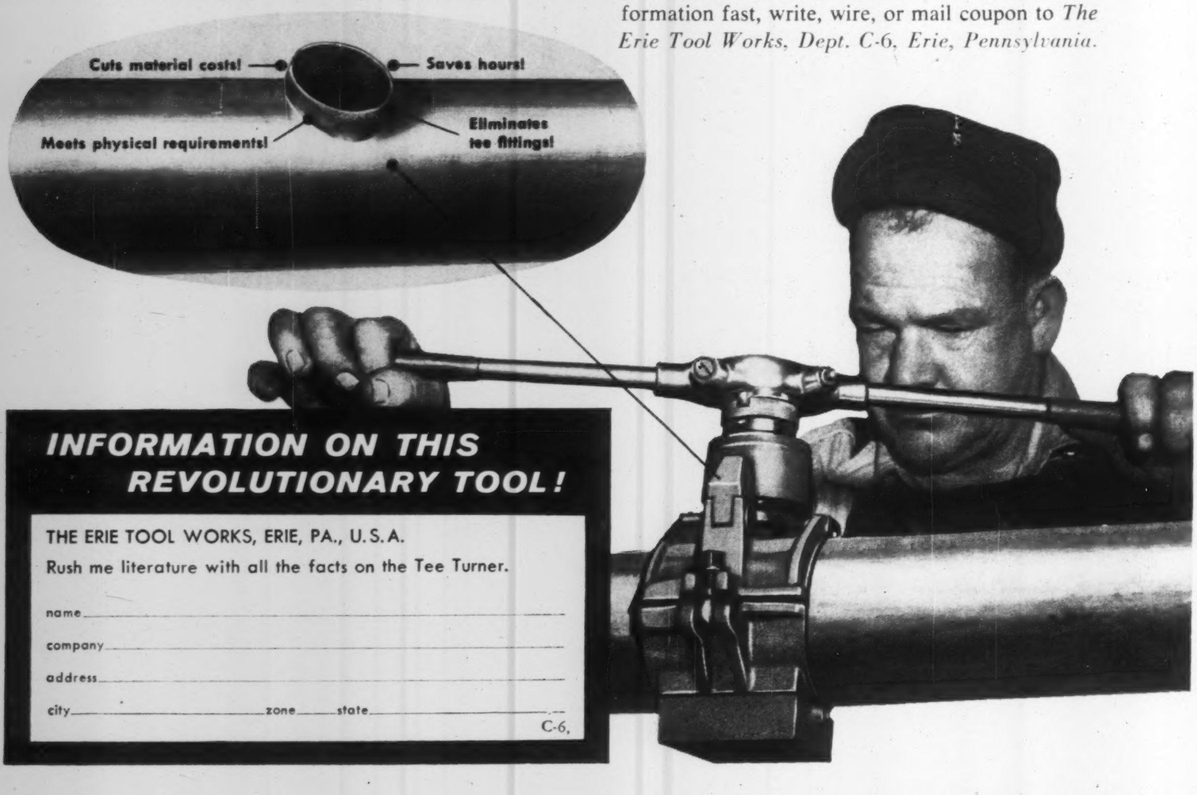
Here's the most revolutionary development in copper plumbing in a decade—a portable tool that "turns" reducing tee connections in K, L, M and DWV copper tubing (1¼" to 4") in five minutes.

The Tee Turner works equally well in the shop or on the job. It saves literally hundreds, even thousands of dollars on big jobs by (1) eliminating the need for reducing tee fittings, and (2) reducing the number of solder joints at each branch from 3 to 1. Cuts labor costs on tubing installations up to 75%!

The Tee Turner has been approved and specified for branching by consulting engineering firms all over the U.S. It has been used in the construction of schools, hospitals, motels, industrial plants, commercial buildings, and residences. In addition, it has proven ideal for remodeling and maintenance work in large plants and commercial buildings.

This tool is already being used by plumbers and mechanical contractors in Boston, Metropolitan New York, Newark, Miami, Buffalo, Pittsburgh, Cleveland, Detroit, Chicago, St. Louis, Dallas, Denver and Los Angeles.

Tee Turner tools are available for both water distribution and drainage systems. For complete information fast, write, wire, or mail coupon to *The Erie Tool Works, Dept. C-6, Erie, Pennsylvania.*



INFORMATION ON THIS REVOLUTIONARY TOOL!

THE ERIE TOOL WORKS, ERIE, PA., U.S.A.

Rush me literature with all the facts on the Tee Turner.

name________________

company________________

address________________

city________ zone____ state________

C-6,

EQUIPMENT DEVELOPMENTS

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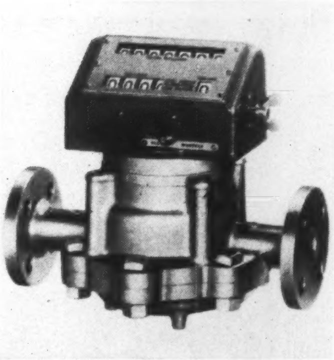
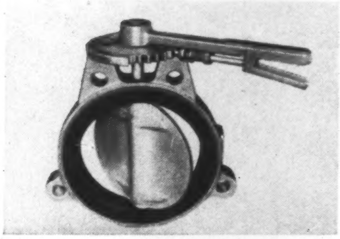


Liquid Meter . . .

. . . ¾ in. size, designed for measuring small flows of wide variety of liquids, with stainless steel internal works, stainless, carbon steel, or cast iron outer casing; available with threaded or flanged connections, various register types — *Buffalo Meter Co., Inc., 2917 Main St., Buffalo 17, N. Y.*

Diamond Bits . . .

. . . for hole sizes from ½ to 14 in. in diameter; diamonds are inserted in metal bonds and mounted on steel tubes; specifications made for brick, tile, stone, and reinforced concrete—*Robert G. Evans Co., 6020 Troost Ave., Kansas City 10, Mo.*

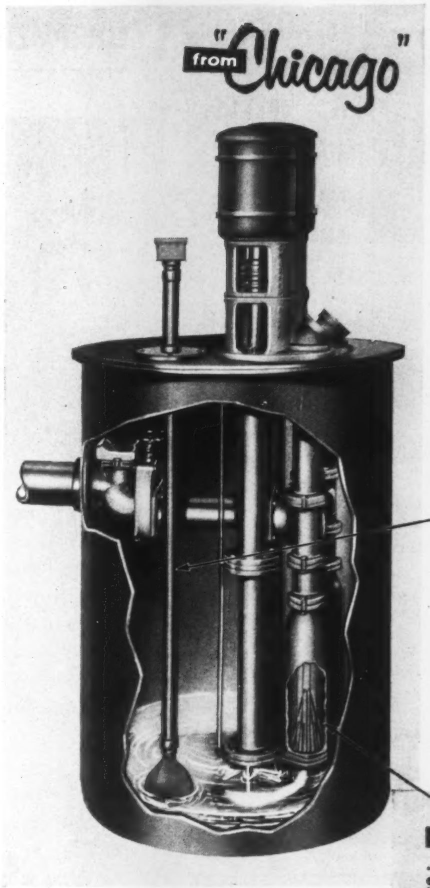


Butterfly Valve . . .

. . . in 2 to 36 in. sizes, 50 and 150 lb pressure ratings, utilizes solid cast streamlined disc which moves from full-open to full-close in ¼ turn, rubber or synthetic seat replaceable liner, bronze bushings for disc shaft; with manual or automatic operating mechanism, valve componets are made of any desired combination of metals—*W. S. Rockwell Co., 200 Eliot St., Fairfield, Conn.*

from "Chicago" . . . the NEW FLUSH KLEEN® story

better than ever FLUSH KLEEN® clog-proof sewage pumping



NOW available with . . .

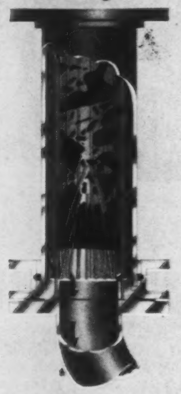
New SEALTRODE*

Sealed Electrode Floatless Pump Controller . . . the *only* pump controller *completely* free of becoming insulated or coated with grease or corrosive elements found in sewage and drainage water.

U. S. Patent No. 2,797,702

New FLO-THRU* Strainer

. . . the heart of the FLUSH KLEEN® System, is now available with FLUSH KLEEN® Sewage Pumps. Clear liquid flows continuously around and through the strainer without obstruction . . . at maximum solids loading.



High Wet Strength Paper Products and other solids . . . are never a problem.

Other Features

- Pumps handle clear liquid only
- Dependable, trouble-free pumping performance
- Minimum maintenance
- 100% standby capacity
- Longer pump life

OVER 13,000 FLUSH KLEEN® INSTALLATIONS

1909 51 YEARS CHICAGO PUMP COMPANY 1960

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PATENTS PENDING

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Putting Ideas to Work

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

FOOD MACHINERY AND CHEMICAL CORPORATION
HYDRODYNAMICS DIVISION
CHICAGO PUMP
622C DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

NEW
SKY WITCH
puts
load and
workmen
at
job height!

Work height
easily varied
with a touch
of the controls

Sky Witch, the new ***CHARLES*** *product, is a...*

WORK-LOAD LIFT!

For construction, installation, and overhead maintenance . . . in industrial plants and commercial buildings . . . chemical plants, refineries . . . inside or outside! Sky Witch offers 6 basic models with various power and mounting options. Portable and hydraulic, it lifts the load and serves as an adjustable work platform . . . heights to 24 feet, loads to 2,000 pounds! Write for details.

CHARLES Machine Works, Inc.

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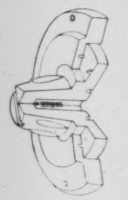
Here is the *NEWEST* and *SMARTEST WAY* to regulate *AIR FLOW!*

DURO-TROL ***another FIRST from DURO-DYNE***



For installation in exposed areas where smart, modern appearance and ease of adjustment are of prime importance, DURO-TROL is the answer! Made of high impact plastic, Duro-trol remains beautiful for years . . . no fading, rusting or peeling.

Exact position of damper is shown at a glance . . . eliminates guesswork. To readjust, simply push in, turn knob and release. Duro-trol clicks and locks into new position.

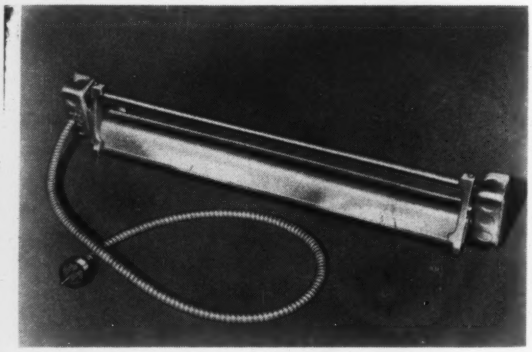
Ask your Duro-Dyne Distributor for a Demonstration

DURO DYNE CORP.

FARMINGDALE, NEW YORK

EQUIPMENT DEVELOPMENTS

Continued

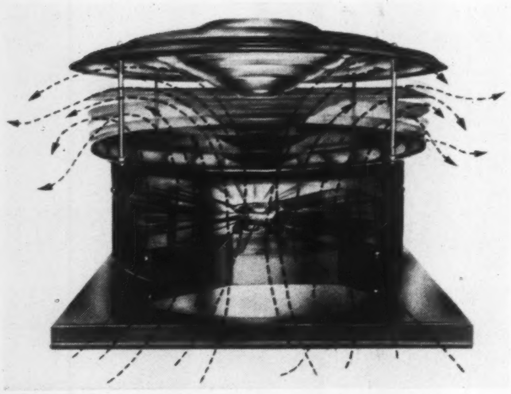


Radiant Heater Assembly . . .

. . . for localized drying or exposed location heating applications available in lengths from 24 to 84 in., with effective heating lengths 6 in. less than total for each size; for 120, 240, or 440 v use, 750 to 3250 w power consumption; with alloy sheathed tube, aluminum reflector, insulated with ceramic bushings at mounting points—*Thermel, Inc., 9400 Robinson Rd., Franklin Park, Ill.*

Anti-Vibration Compound . . .

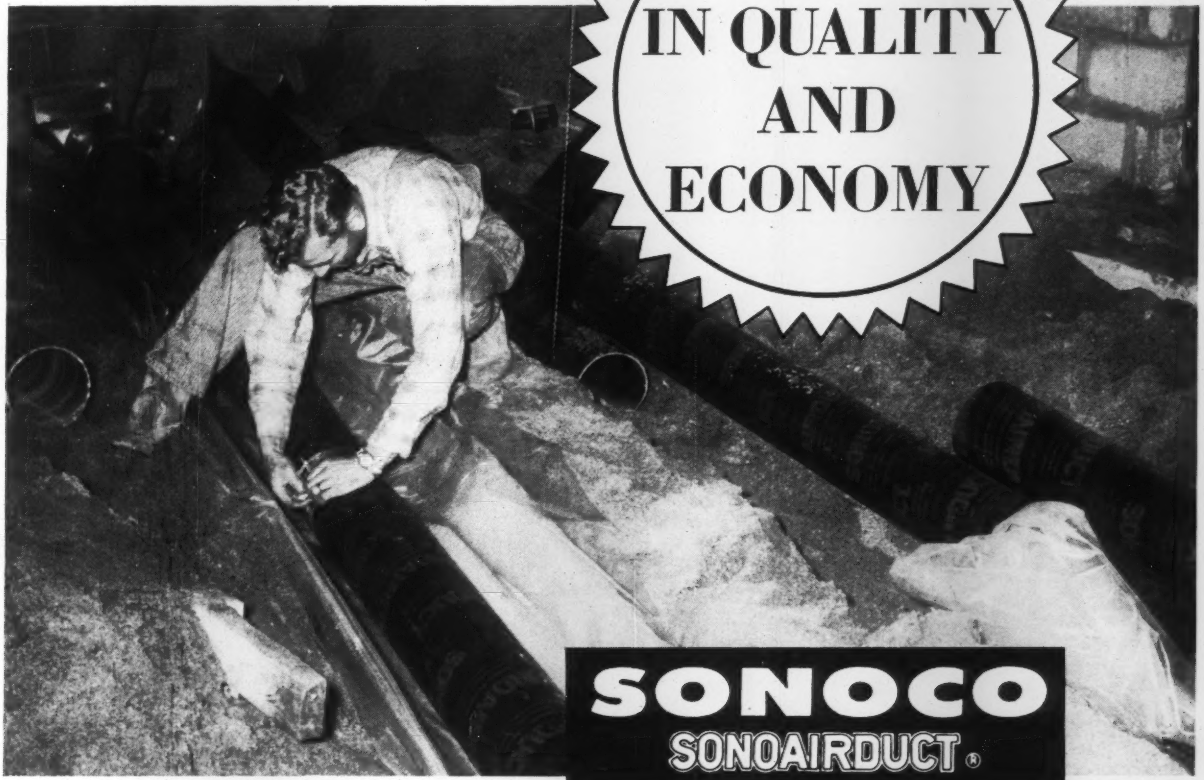
. . . for damping of structure-borne vibration and noise can be sprayed or troweled onto metal sheets, dries to smooth finish, is non-toxic and non-flammable and resistant to alkali, grease, other corrosive elements; material provides vibration decay rate of 35 to 55 db per second, according to manufacturer—*The Korfund Co., 48-01 F 32nd Place, Long Island City 1, N. Y.*



Power Roof Exhauster . . .

. . . features automatic operation of lift-type damper; discharged air lifts aluminum damper cone to seat against cover diverting air for 360 degree discharge; damper returns to lowered position when fan is turned off, providing weather-tight seal, according to manufacturer—*Genie-Air, Inc., P.O. Box 39691, Los Angeles 39, Calif.*

TOPS IN QUALITY AND ECONOMY



Iowa Concrete Block and Material Co. Office Building, Des Moines, Iowa. General Contractor: The Weitz Co., Inc. Sub-Contractor: Heating-Conditioned Air Corp. Architect: Nemmers & Meehan. Engineer: Heating Wholesalers Co.

SONOCO SONOAIRDUCT® FIBRE DUCT

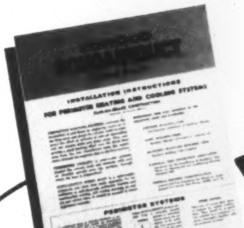
for slab perimeter heating and cooling

Low first cost, faster installation, highest quality – you get *all three* when you use F.H.A.-accepted SONOAIRDUCT Fibre Duct for slab perimeter heating, cooling, or combination systems.

SONOAIRDUCT handles easily, levels and joins quickly . . . saving time and labor on the job. Long lengths mean fewer joints to make, and there are no sharp cutting edges to worry about. Every piece is usable, because SONOAIRDUCT won't chip, crack, or break when dropped.

Highest quality is assured, too, because SONOAIRDUCT has been subjected to F.H.A. testing procedures – meeting or exceeding all criteria and test requirements for products in this category. Year in and year out, aluminum foil-lined SONOAIRDUCT is America's best selling Fibre Duct – proof of its dependable performance.

Order Sonoco SONOAIRDUCT Fibre Duct in 23 sizes, 2" to 36" I.D., in standard 18' lengths – special sizes to order. Can be sawed.



FREE INSTALLATION MANUAL
Contains latest, detailed, step-by-step installation data for SONOAIRDUCT Fibre Duct. For free copy, send us your name and address on company letterhead.

See our catalog in Sweet's, or write for complete information to

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Construction Products

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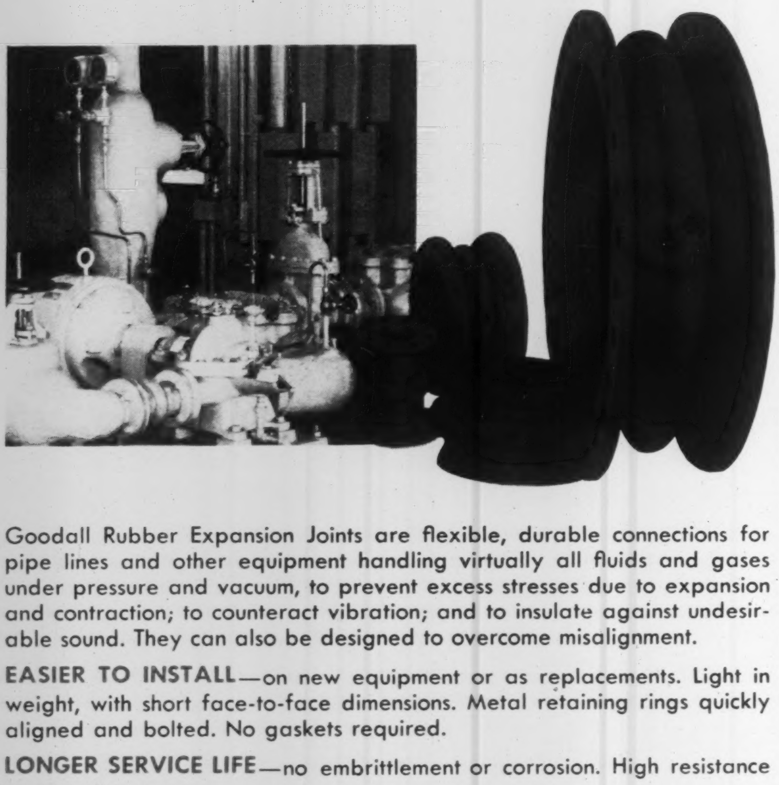
4903

Save ... ON INSTALLATION AND REPLACEMENT COSTS

With

GOODALL *Rubber* EXPANSION JOINTS



Goodall Rubber Expansion Joints are flexible, durable connections for pipe lines and other equipment handling virtually all fluids and gases under pressure and vacuum, to prevent excess stresses due to expansion and contraction; to counteract vibration; and to insulate against undesirable sound. They can also be designed to overcome misalignment.

EASIER TO INSTALL—on new equipment or as replacements. Light in weight, with short face-to-face dimensions. Metal retaining rings quickly aligned and bolted. No gaskets required.

LONGER SERVICE LIFE—no embrittlement or corrosion. High resistance to abrasive wear.

STYLES, SIZES AND PRESSURES TO MEET ALL REQUIREMENTS

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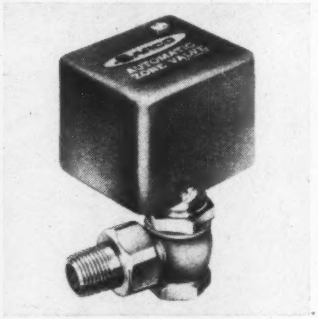
BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES.
IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.

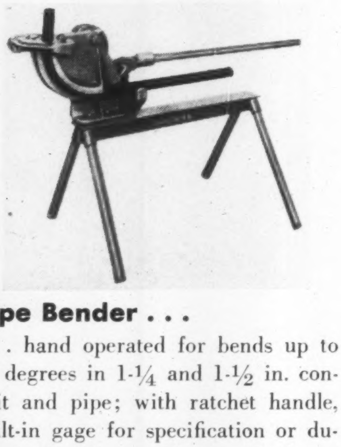


Automatic Control Valve

... for zone control of hot water, steam, and radiant heating systems and for fan-coil heating and cooling systems operates on 24 v a-c, features thermostat-actuated control of circulator or burner; in five models, valve offers silent operation, tight shut-off, electrically isolated end switch, standby manual operator, position indicator, according to manufacturer—*Sarco Co., Inc.*, 635 *Madison Ave., New York* 22, *N.Y.*

Emulsion Coating . . .

. . . for insulation adhesive use on underground piping and other applications and for insulation top coating is cold-applied, said to be highly resistant to chemical permeation—*Koppers Co., Inc., Koppers Building, Pittsburgh* 19, *Pa.*



Pipe Bender . . .

. . . hand operated for bends up to 90 degrees in 1-1/4 and 1-1/2 in. conduit and pipe; with ratchet handle, built-in gage for specification or duplicate bending, swing-away clamp, base threaded for 1-1/4 in. legs for bench or floor mounting—*Greenlee Tool Co.*, 2136 12*th St., Rockford, Ill.*

FOR THE FIRST TIME UNDER ONE COVER

All the information needed for designing Complete Direct Fired Industrial Heating Systems prepared from over 65 years of product experience

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Established 1895

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INDUSTRIAL DIRECT FIRED* HEATERS

heat loss calculations
nozzle and duct distribution
controls
door heating
process heating
make-up air
central furnace applications
fuel piping design
fuel consumption
reference data

No longer are several data sources needed to design industrial heating jobs using direct-fired heaters. This *comprehensive* text, prepared by 65 year old Lennox Industries Inc., covers:

Space heating survey procedures
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Conduction, infiltration and exhaust calculations
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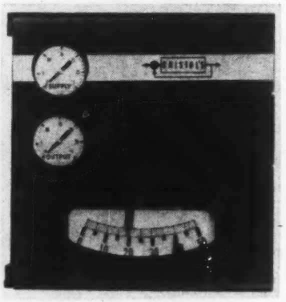
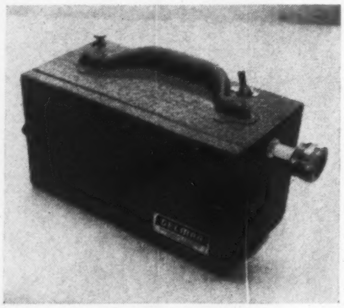


Pneumatic Controller . . .
. . . indicating, for pressure, temperature, flow and differential, humidity, and differential liquid level control; available in models for 1 to 400 percent proportional control, 0.1 to 50 repeats per minute reset rate control; in aluminum case for various mountings, unit is said to have excellent ambient temperature stability — *The Bristol Co., P. O. Box 1790, Dept. HPAC, Waterbury, Conn.*

Pipe Thread Tape . . .
. . . of synthetic material is applied directly to threads for "permanent" seal; said to be unaffected by acids, gases, steam, or temperatures between −400 and 600 F; prevents rust and corrosion of threads, according to manufacturer—*Dodge Fibers Corp., Hoosick Falls, N.Y.*



Air Sampler . . .
. . . portable, for sampling at 2 cfm rate; with centrifugal pump unit, built-in fan, for 110 v a-c, 6, 12, and 24 v d-c operation; flowmeter is calibrated in liters per minute; sampler is supplied with 1 in. open filter holder—*Gelman Instrument Co., 106 N. Main St., Chelsea, Mich.*

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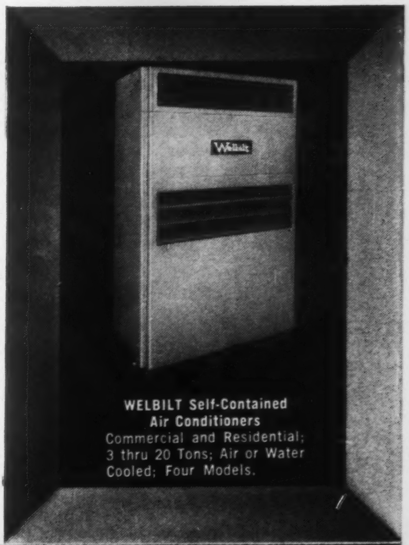
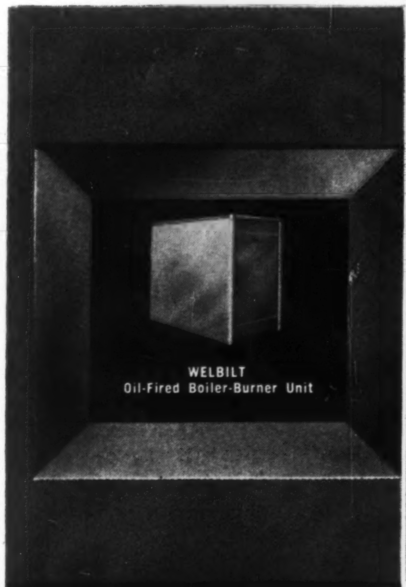
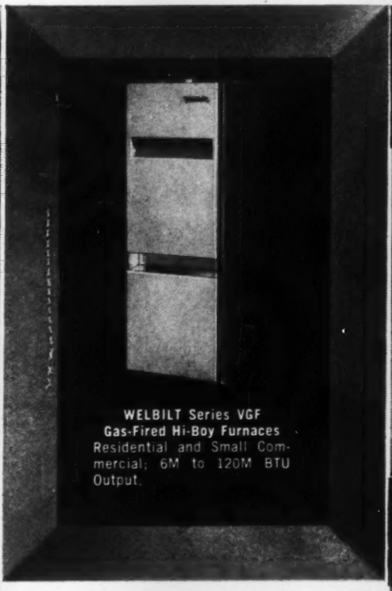
the complete line



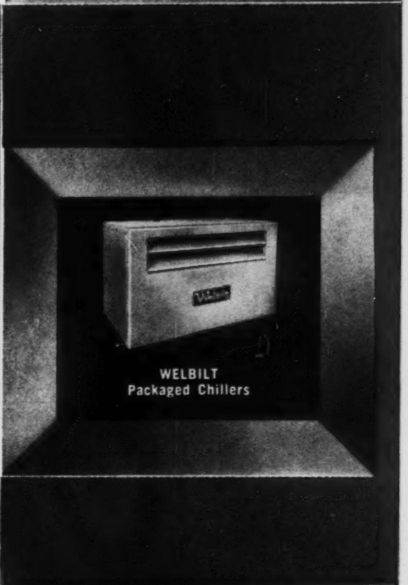
WELBILT Self-Contained Air Conditioners
Commercial and Residential; 3 thru 20 Tons; Air or Water Cooled; Four Models.



WELBILT
Oil-Fired Boiler-Burner Unit



WELBILT Series VGF Gas-Fired Hi-Boy Furnaces
Residential and Small Commercial; 6M to 120M BTU Output.



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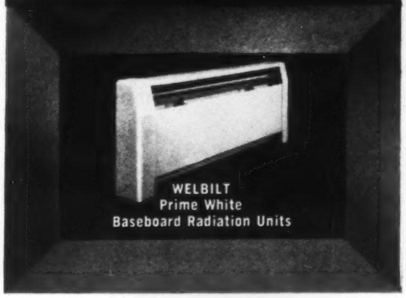
Packaged Chillers



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Prime White
Baseboard Radiation Units

...America's newest, most modern line of quality Air Conditioning, Heating and Refrigerating Equipment. **Welbilt** offers you a complete line of highest quality units, fully guaranteed, strongly supported by a continuous program of technical assistance, and backed by a **clean-cut** marketing policy featuring solid protection for **all** resale groups. Whether you sell, service or specify—look to **Welbilt** for the fairest in policy . . . the finest in quality products.

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SUBSIDIARY OF WELBUILT CORPORATION
Farmingdale, New Jersey

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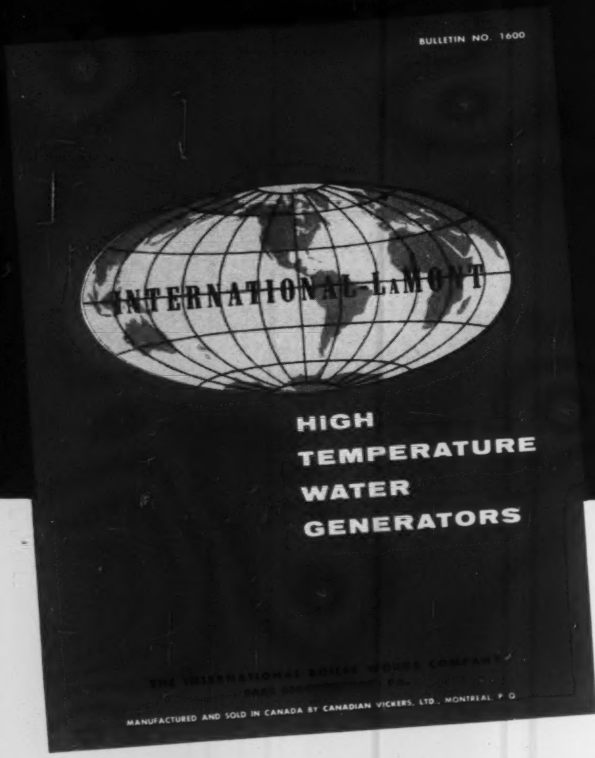
the latest information on...

HIGH TEMPERATURE WATER



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THE INTERNATIONAL BOILER WORKS COMPANY
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Be sure to obtain a copy of this informative, new bulletin on International-LaMont forced recirculation generators for high temperature water, including the latest engineering data.

Send the coupon below or write for your copy of Bulletin 1600 today.

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EQUIPMENT DEVELOPMENTS

Continued

Balancing Valve . . .

. . . for installation in water coil return line of heating and cooling systems features "memory" design which allows balance position to be fixed after which valve can be opened only to that position; valve can also be shut off, eliminating need for second series-connected valve in line, according to manufacturer; available in ½, ¾, 1, and 1¼ in. sizes and four straightway patterns—*American Air Filter Co., Inc.,* 215 *Central Ave., Louisville* 8, *Ky.*

Industrial Thermometer

. . . has 6 ft stem for liquid and gas temperature measurement in stacks, ducts, tanks, etc., is constructed of stainless steel and available in temperature ranges from 0 to 200 F up to 200 to 1000 F; with various dial sizes up to 5 in. diameter, also available with C calibrations—*W. C. Dillion & Co., Inc.,* 14620 *Keswick St., Van Nuys, Calif.*

Pipe Joint Sealer . . .

. . . tape type, for wrapping male threads, of chemically inert synthetic material, said to withstand corrosive liquids and gases at temperatures from −250 to 500 F, in four widths to accommodate various pipe diameters and thread extensions; sealer remains plastic for easy disconnection—*Crane Packing Co., Dept. HA-8,* 6400 *Oakton St., Morton Grove, Ill.*

ENGINEERING NEWS

NATIONAL AIROIL BURNER CO., INC. • 1284 E. Sedgley Ave. • Philadelphia 34, Pa.

You may wish to check certain items in this advertisement and forward to those concerned in your company.

ROUTE TO:

NEW! NATIONAL AIROIL TYPE C-45 OIL BURNER

Pressure Atomizing Burner Specially Engineered and Approved for Nos. 4 and 5 Commercial Fuel Oils

For reliable, quiet heating at lowest cost in buildings requiring 3,600 to 12,000 square feet of radiation, your best investment is this *new* specially-engineered, proven, approved National Airoil unit. Its moderate first cost is paid for quickly through fuel savings and less service. And, its rugged design and precision construction assure many years of satisfactory operation.

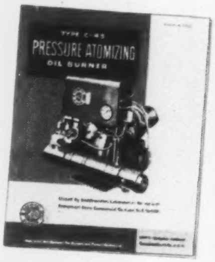
Heavy oil is heated to the correct atomizing temperature in an electric heater with an integral *dual* thermostatic control.

Oil is atomized by pressure alone. The unit is furnished for on-off or on-off with low flame start operation.

You'll be pleasantly surprised at the easy starting, the orange colored, high temperature flame and good combustion secured with the Type C-45 Oil Burner, whether in a standard cast-iron or steel fire box boiler, or in the latest type "pressurized" boilers.

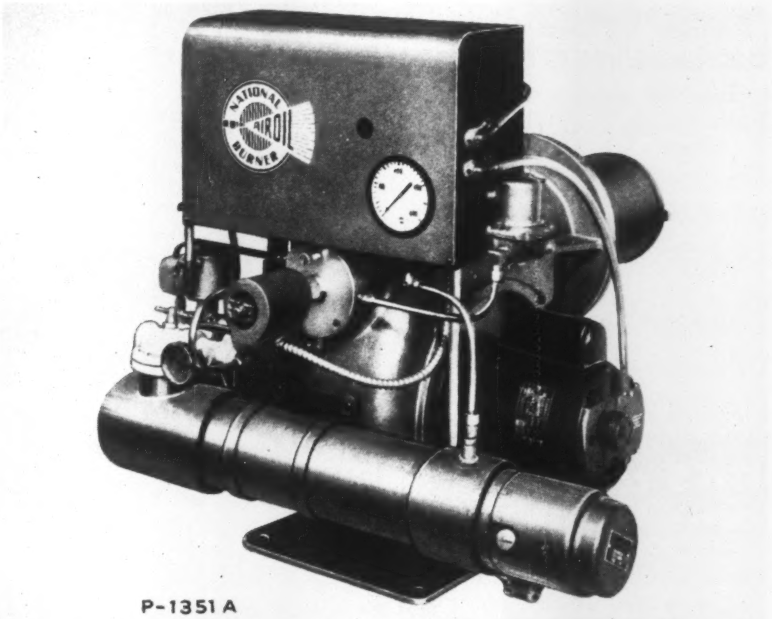
What's more, the Type C-45 Oil Burner is an excellent replacement for light oil burners in the range of 10 to 33 gph. The unit can be installed to use light oil without placing the electric oil heater in service, and change to No. 4 or No. 5 oil at any time in the future.

Bulletin 100 T contains complete data on the Type C-45 Oil Burner in its several natural or induced draft models and pressurized model. Write for a copy today.



TYPE C-45

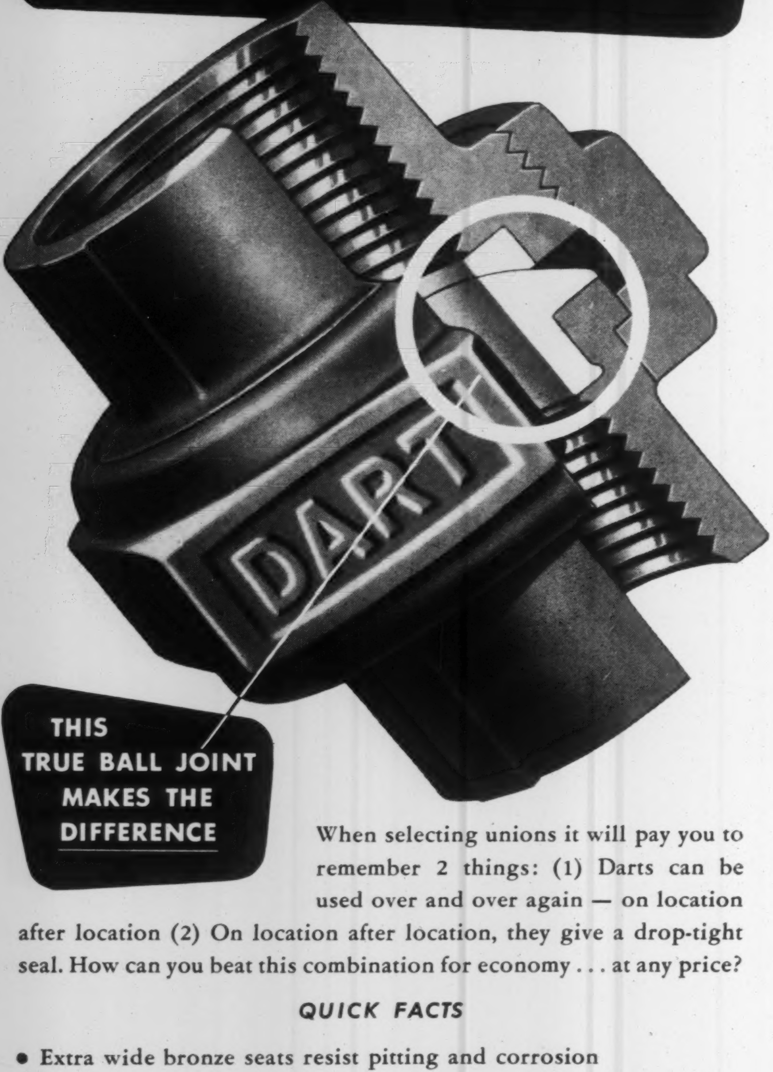
PRESSURE ATOMIZING OIL BURNER



P-1351 A

Check These Plus-Value Advantages of the Type C-45 Pressure Atomizing Oil Burner

- ✓ No float valves to stick open or closed.
- ✓ No oil level to maintain.
- ✓ No air compressor or multipistons to lubricate, maintain or replace.
- ✓ Simple, standard parts.
- ✓ A unit that is easily understood and serviced by any good oil burner mechanic.
- ✓ As easy to install and service as a residential gun type oil burner.
- ✓ All controls, except limit switch and thermostat, are mounted in enclosed control cabinet, factory wired and tested, with terminal block coded for easy field connections.
- ✓ All air needed for combustion is furnished by burner blower—no secondary air openings are required.
- ✓ Prepurge of cold oil and delivery of hot oil, of proper viscosity, right at the nozzle, before burner start. This insures easy, smooth start every time.
- ✓ All valves and component parts are included.
- ✓ Electronic combustion safety controls provide utmost in safety.
- ✓ Quality construction for maximum years of reliable service.


Costs Less Because
It Gives the Most in Service

DART
THIS TRUE BALL JOINT MAKES THE DIFFERENCE

When selecting unions it will pay you to remember 2 things: (1) Darts can be used over and over again — on location after location (2) On location after location, they give a drop-tight seal. How can you beat this combination for economy . . . at any price?

QUICK FACTS

- Extra wide bronze seats resist pitting and corrosion
- Nut and body of air-refined, high test malleable iron are practically unbreakable
- Heavy shoulders can withstand the toughest wrench abuse
- Each Dart is individually vacuum-tested

DART UNIONS *Products of* DART UNION COMPANY PROVIDENCE 5, R.I.

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EQUIPMENT DEVELOPMENTS

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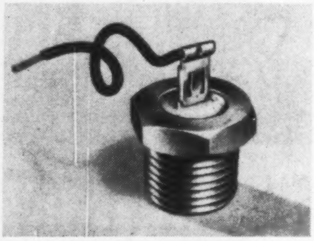
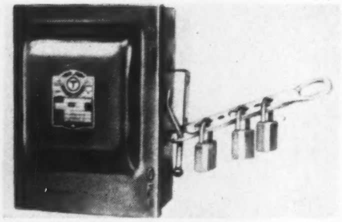


Temperature Control . . .

. . . for industrial air compressor, other applications can be used for high limit or controlling thermostat; said to be highly vibration resistant, features sealed construction, constant thermal and electrical contact, rapid temperature response action; for temperature setting range of −65 to 325 F, −40 to 300 F ambient range; operating temperature tolerances: open ±8 F, close ±5 F, differential 2 F—*Therm-O-Stats Inc., Box 303, Chartley, Mass.*

Insulation Adhesive . . .

. . . for blanket or block form insulation materials can be applied with brush or scraper blade; non flammable, said to reliably bond all insulation materials to sheet metal for operating conditions over wide range of temperatures; in 2/3 or 1 gallon cans—*Grant Wilson, Inc., Dept. HA-8, 141 W. Jackson Blvd., Chicago 4, Ill.*



Lockout Device . . .

. . . for use on power boxes has provision for use of up to six padlocks; of cadmium plated steel, unit is designed to prevent accidental throwing of switch while maintenance is being performed on equipment—*Industrial Products Co., 2666 N. 4th St., Philadelphia 33, Pa.*

A New Era in Relay Life and Reliability

0A01P
110V 60CY
93V 50CY

NEW
Bulletin 700,
Type B-220A,
AC Control
Relay with
2 N.O. and
2 N.C. contacts.

NEW
Bulletin 700,
Type BX-440A,
AC Control
Relay can be
wired for
normally open
or normally
closed contacts.

NEW ALLEN-BRADLEY BULLETIN 700 RELAYS

Improved features set new performance standards

For years, Allen-Bradley Bulletin 700 Type B and Type BX relays have been preferred for their long life and trouble free operation. The improvements in the new Bulletin 700 Type B and Type BX relays will set new performance standards wherever they are used. Naturally they use the famous A-B double break, silver alloy contacts which always remain in perfect operating condition without cleaning or filing. The molded coil cannot be damaged by the severest atmospheric conditions.

These new Allen-Bradley Bulletin 700 Type B and Type BX relays offer even greater value and greater reliability than ever before—but the price has not been changed.

- **New mechanical design gives at least 5 times greater operating life.**
- **New contact motion provides 10 times greater electrical reliability.**
- **Complete interchangeability—mounting dimensions are unchanged.**
- **New hermetically sealed molded coil fits Bulletin 700 relays presently in use.**
- **New, stronger, movable contact crossbar—also fits old relays.**
- **New reinforced stationary contact blocks—interchangeable with previous design.**

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY Quality Motor Control

Member of NEMA

ROBVON BACKING RINGS
FAST · PRECISE TOLERANCE FIT-UPS

Designed for quick easy alignment of pipe where the variation in inside diameters is relatively great. Chamfered NUBS allow close tolerance fit-up and CLEAN STRIKE OFF. The ROBVON NUB automatically sets root gap. ROBVON rings are beveled to assure non-restricted fluid flow. Available in Carbon Steel, Wrought Iron, Chrome Alloys, Stainless Steel and Aluminum.

TYPE "CCC"

ROBVON BACKING RING CO.
Reg. Pat. Nos. 2,764,426 & 2,366,579
675 Garden St., Elizabeth 2, N. J., PH: EL 2-9613

A.O. Smith has the horses!

800 to 1 hp favorites for quiet operation, low maintenance and long-life service . . .

From the case of the A. O. Smith Motor Man — a complete stable of integrals that include single-phase models (1-5 hp) or polyphase (1-800 hp). Also a team of fractional-hp motors. All are sure bets to give top performance over the long, long haul.

And there's an A. O. Smith Motor Man near you — chomping at the bit to give you 24-hour action on all parts and service orders.

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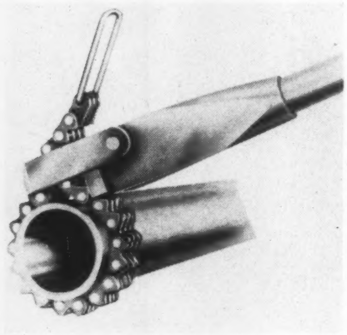
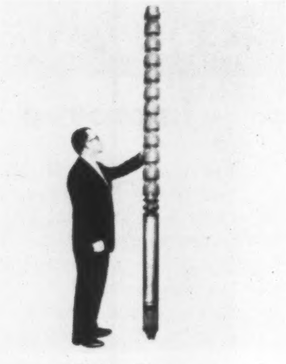
A. O. SMITH INTERNATIONAL, S.A.
Milwaukee 1, Wisconsin, U.S.A.



Chain Wrench . . .

. . . for round and odd shapes of pipe, tubing, shafts, etc., employs chain which is smooth on inner side to exert torsional force around entire circumference of pipe; works with up-and-down ratchet action of handle, said to withstand 13,000 lb torque without slipping, requires only $\frac{1}{4}$ in. clearance between pipe and wall; in three sizes for $\frac{3}{4}$ to 6 in. diameter pipe—*Aladdin's Products, Inc., 50 W. Broad St., Columbus 15, O.*



Submersible Pumps . . .

. . . for 6 in. or larger deep wells, in 16 sizes from 5 to 40 hp, capacities up to 180 gpm from well depths to 1450 ft; bowl assemblies have cast iron bowls, bronze impellers, stainless steel fastenings; motors are water lubricated, motor leads are protected with stainless steel guards; unit can be assembled with from 2 to 23 stages—*Goulds Pumps, Inc., 208 Black Brook Rd., Seneca Falls, N.Y.*

ANNOUNCING...

THE NEW BURNHAM
3-PASS SCOTCH-TYPE PACKAGED STEEL BOILER

Here's a high point in efficient, low maintenance heating for schools, office buildings, all commercial and institutional installations! Designed to the latest SBI ratings for Scotch-Type 3-pass low pressure installations, these modern new boilers have certified efficiencies of better than 80%. Flue gas temperatures are in the 400° to 450° range. Perfectly balanced draft conditions between the second and third passes, help make these units outstanding performers. They are available as bare boilers or as complete boiler-burner packages for oil, gas or oil/gas combination firing. Sizes range from 20 to 800 hp. new five sq. ft. fireside heating surface ratings per hp. Write for full details now.

Also available for prompt shipment:
Scotch-Type 2-pass boilers; Compact-Type Table 1 and Table 2 steel boilers.

Burnham Corporation

Steel Boiler Department
Irvington, New York

MEMBER SBI

Sales Representatives throughout the U. S. A.

Burnham Corporation HP-60
Steel Boiler Department
Irvington, New York

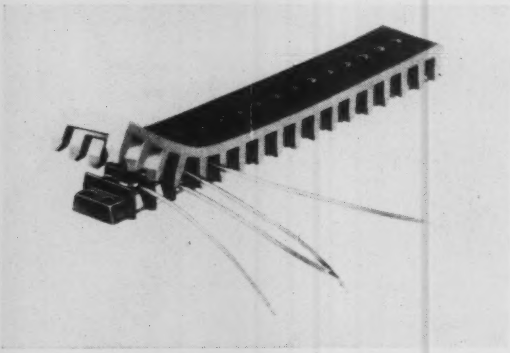
Please send me, without obligation, full ratings and data on:

☐ Scotch-Type 3-pass Boilers
☐ Scotch-Type 2-pass Boilers
☐ Compact Boilers
☐ Boiler-Burner Packages

Name ....

Address ....

City .... State ....

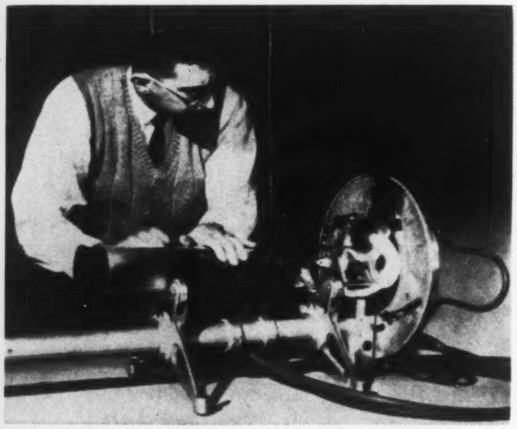


Terminal Block Covers . . .

. . . rubber, in three types: flexible casing, with wall between each terminal pole, pegged edge for attachment to block; barrier strip model with grooved dividers; thimble-type for use on individual terminal pole—*TA Mfg. Corp., 4607 Alger St., Los Angeles 39, Calif.*

Electrostatic Deodorizer . . .

. . . features four electrostatic air thrust cylinders to deodorize 320 cfm of air; device operates without chemicals or filters, uses a-c current—*Morris Deodorizers, Inc., 2819 Broadway, N.E., Knoxville 17, Tenn.*

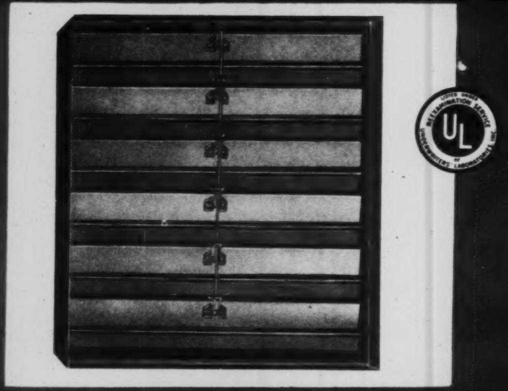


Glass Beading Kit . . .

. . . for field scoring and cutting of glass pipe consists of single burner and cutting device for all pipe sizes from 1 to 6 in. diameter; scores pipe internally for breaking by gas flame; available for purchase or rental, obviates need for ordering custom made sections, according to manufacturer—*Corning Glass Works, Corning, N.Y.*

FIRST and ONLY FIRE DAMPER

PRODUCED UNDER THE FACTORY INSPECTION AND LABEL SERVICE PROGRAM OF THE UNDERWRITERS' LABORATORIES INC.


UL
LISTED UNDER REEXAMINATION SERVICE OF UNDERWRITERS' LABORATORIES, INC.

No. VWNYT-1
AUTOMATIC LOUVERED FIRE DAMPER

This acceptance by the UNDERWRITERS' LABORATORIES came only after extensive tests with FIRE DAMPERS constructed according to the present Bulletin No. 90 SERIES, which failed to pass the test, and the IMPERIAL DAMPER No. VWNYT-1, which passed the test, and now carries the UNDERWRITERS' LABORATORIES LABEL.

We, also, at this time, proudly announce the APPROVAL AND LABELING of the IMPERIAL DAMPER No. VWNYT-1 by the BOARD OF STANDARDS AND APPEALS FOR USE IN NEW YORK CITY. This is the FIRST AND ONLY DAMPER to date to carry this approval and label.

Send for Our New Informative Brochure!

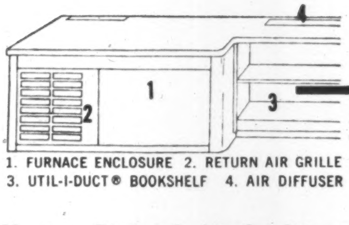
IMPERIAL
DAMPER COMPANY
664 EDGECOMBE AVENUE
NEW YORK 32, N. Y.
LOrraine 8-9100

Manufacturers of Volume Dampers, Multi-Blade Dampers, Automatic Dampers, Automatic Shutters, Back-Draft Shutters, Louvers, Stationary and Adjustable Extruded Aluminum Louvers.

round-the-room comfort at down-to-earth cost

Gas-fired **Norman Schoolroom Heating and Ventilating Systems** are installed quickly at low cost . . . and there's plenty of latitude for future economy in school expansion! Each Norman forced warm-air system supplies heat rapidly when it is needed . . . blends fresh outdoor air and recirculated room air to cool and ventilate the schoolroom . . . and distributes tempered air evenly along and out from the exposed walls. Expensive boiler rooms, stacks, pipe tunnels, boilers and control panels are eliminated right from the start. As the school grows, additional Norman Systems can be added.

Write Today for New 1960 Comprehensive Manual
See folder in 1960 Sweets Arch. File 31h/No

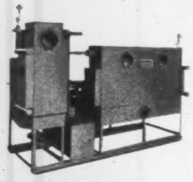


1. FURNACE ENCLOSURE 2. RETURN AIR GRILLE
3. UTIL-I-DUCT® BOOKSHELF 4. AIR DIFFUSER

Norman®
PRODUCTS CO. • 1156 Chesapeake Ave. Columbus 12, Ohio

NEW DURABLE KATHABAR® SYSTEMS

offer high performance with new low maintenance for years of troublefree service



LOW MAINTENANCE

Rugged new Kathabar design provides all-nickel regenerator, separate from rest of system, to prevent condensation corrosion. Breaking all records for low maintenance, all over the world.

WIDE USAGE

Successfully applied in wide range of industries, hospitals, buildings. Easily provide conditions of 80° F and 35% RH to 30° F and 10% RH. Deliver air at -90° F dew point.

ENGINEERS LIKE

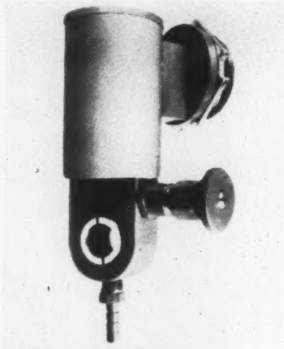
Consulting engineers like the Kathabar system: no re-heat, no frost, no chemical carryover. Humidity, independent of dry bulb, controlled with no reversing or interruption for regeneration.

GET FACTS

SURFACE COMBUSTION
A division of Midland Ross Corporation
2384 Dorr Street, Toledo 1, Ohio
Send facts on Kathabar systems for following application:
....
name & title ....
company ....
street ....
city .... zone .... state ....

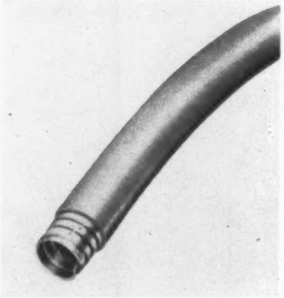
59-7

In Europe: NEDAIRCO, The Hague. In Japan: CHUGAIRO, Osaka.



Liquid Proportioner . . .
. . . gravity feed type, of plastic and other synthetic construction, for drop-rate feeding, with built-in head loss equalizer, connection for 2 in. threaded fittings; said to provide accurate rate from 1 drop per minute to 10 gph—*Sterling E. Norcross Co. 19 Osborne St., Bloomfield, N.J.*

Paste-type Rubber . . .
. . . for use as general purpose repair material, adhesive on rubber, metals, plastic, fabrics, other materials, is permanently flexible, fast setting, unaffected by oil, gasoline, most chemicals, according to manufacturer; available in pint, gallon, or 5-gallon, containers—*Devcon Corp., Danvers, Mass.*



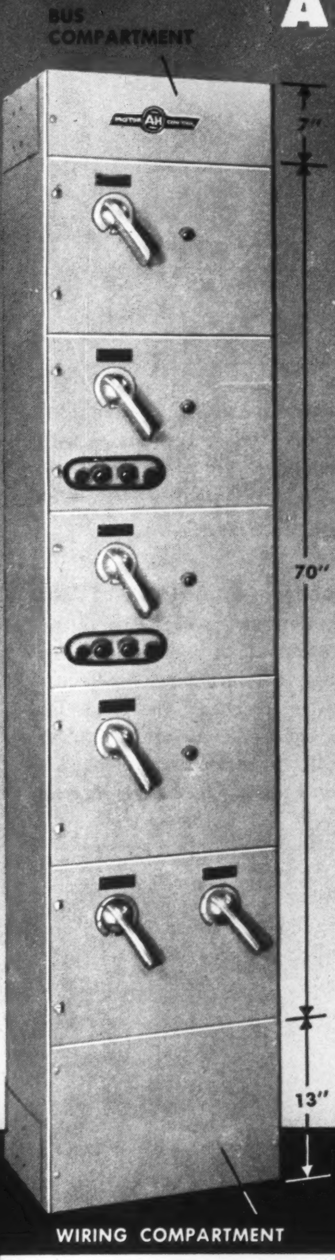
Flexible Conduit . . .
. . . for protection of wiring in wet areas; with polyvinyl chloride synthetic resin cover, copper wire positive ground, is resistant to flame, oils, grease chemicals; applicable to connections between moving members and stationary parts, available in 3/8 to 1¼ in. sizes—*The International Metal Hose Co., Bellevue, O.*

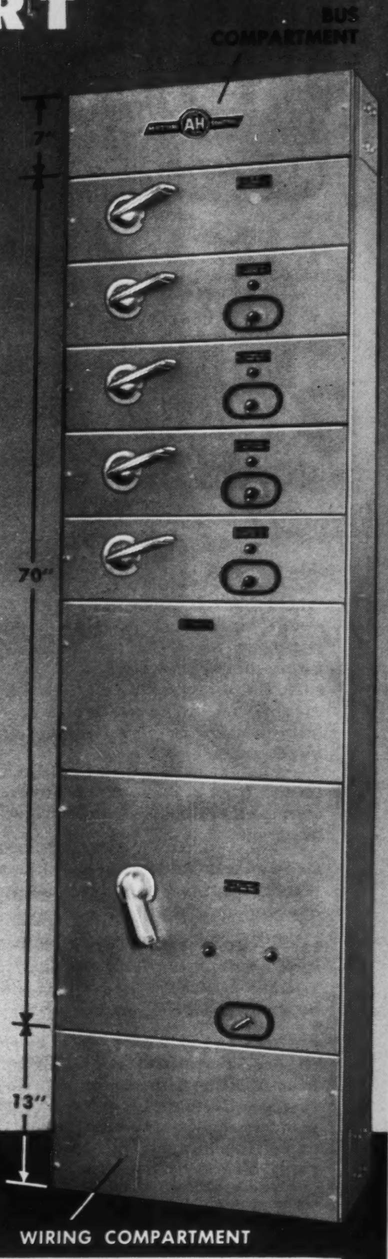
NEW!

ARROW AH HART

CONTROL CENTERS

TYPE "MC"





these advantages will help you

MUCH GREATER SPACE SAVINGS . . . because the Arrow-Hart Motor Control Units in these Control Centers are half the size and weight of comparable controls. *ARROW-HART* offers a control center with up to 10 Size 1 control cells in a single vertical section 90" high.

FASTER, LOWER-COST INSTALLATION . . . because all controls are delivered in a single pretested, ready-to-install "package." If specified, all interwiring, sequencing, interlocking etc. are pre-engineered.

GREATER DEPENDABILITY . . . because of the superior performance of the individual Arrow-Hart Control Units and simplified maintenance because all controls are centralized in a single convenient location, away from shop dust and dirt. Individual cells are plug-in type for quick removal, replacement or re-assembly.

COMPLETE FLEXIBILITY, VERSATILITY . . . practically any desired combination of units can easily be assembled . . . or modified.

MOST COMPLETE LINES AVAILABLE ANYWHERE . . .

COMBINATION STARTER UNITS: Non-Reversing, Reversing, 2-Speed, Part-Winding, and Reduced Voltage Starter Types in NEMA Sizes 1 through 5 . . . in combination with Fused or Unfused Disconnect Switch or Circuit Breaker of Thermal Magnetic or Instantaneous Trip Type.

ENCLOSURES: NEMA 1 (General Purpose), NEMA 1-A (Semi-Dustight), NEMA 3 (Outdoor), NEMA 5 (Dustight), and NEMA 12 (Industrial Use) — in standard or back-to-back arrangements.

WIRING: NEMA A, B or C — Class I or II.

OTHER CONTROL UNITS: Include Lighting Panels, Transformers, Metering Equipment, and a Complete Line of Pilot Devices.

TYPE MC-5
20" WIDE
Up to 5 Size 1
Control Cells

preferred for most general purpose industrial applications.

GET COMPLETE INFORMATION NOW!

Write today for fully descriptive literature. The Arrow-Hart & Hegeman Electric Company, Dept. HPAC, 103 Hawthorn St., Hartford 6, Conn.

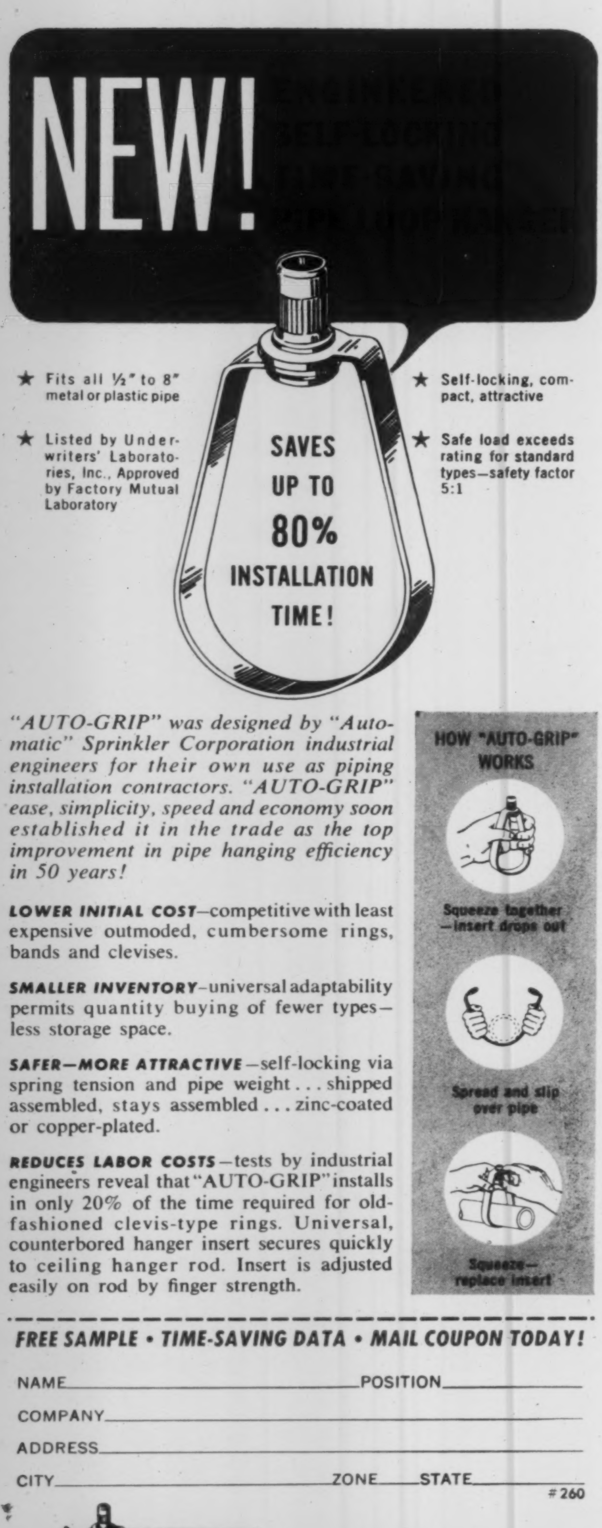
ARROW AH HART

Quality since 1890

MOTOR CONTROLS · ENCLOSED SWITCHES
APPLIANCE SWITCHES · WIRING DEVICES

TYPE MC-10
25" WIDE
Up to 10 Size 1
Control Cells

preferred for schools and other commercial, and institutional applications that call for maximum space savings.



NEW! ENGINEERED SELF-LOCKING TIME-SAVING PIPE LOOP HANGER

★ Fits all ½" to 8" metal or plastic pipe

★ Listed by Underwriters' Laboratories, Inc., Approved by Factory Mutual Laboratory

★ Self-locking, compact, attractive

★ Safe load exceeds rating for standard types—safety factor 5:1

SAVES UP TO 80% INSTALLATION TIME!

"AUTO-GRIP" was designed by "Automatic" Sprinkler Corporation industrial engineers for their own use as piping installation contractors. "AUTO-GRIP" ease, simplicity, speed and economy soon established it in the trade as the top improvement in pipe hanging efficiency in 50 years!

LOWER INITIAL COST—competitive with least expensive outmoded, cumbersome rings, bands and clevises.

SMALLER INVENTORY—universal adaptability permits quantity buying of fewer types—less storage space.

SAFER—MORE ATTRACTIVE—self-locking via spring tension and pipe weight . . . shipped assembled, stays assembled . . . zinc-coated or copper-plated.

REDUCES LABOR COSTS—tests by industrial engineers reveal that "AUTO-GRIP" installs in only 20% of the time required for old-fashioned clevis-type rings. Universal, counterbored hanger insert secures quickly to ceiling hanger rod. Insert is adjusted easily on rod by finger strength.

HOW "AUTO-GRIP" WORKS

Squeeze together—insert drops out

Spread and slip over pipe

Squeeze—replace insert

FREE SAMPLE • TIME-SAVING DATA • MAIL COUPON TODAY!

NAME__________ POSITION__________

COMPANY__________

ADDRESS__________

CITY__________ ZONE_____ STATE__________

#260

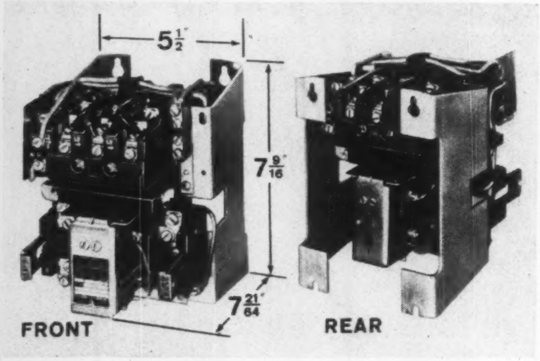
AUTO GRIP ® "Auto-Grip" Division

Box 360 • Youngstown 1, Ohio

"Automatic" Sprinkler CORPORATION OF AMERICA

EQUIPMENT DEVELOPMENTS

Continued

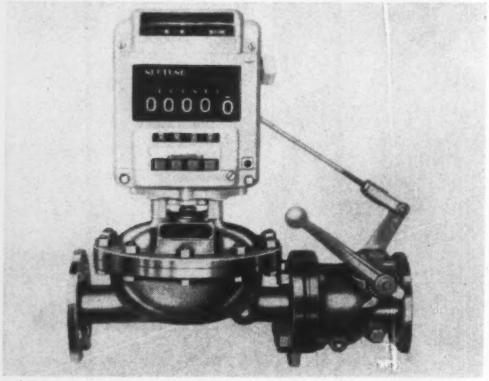


Reversing Starters . . .

. . . featuring "piggy-back" mounting design for economy of space, in NEMA sizes 0, 1, 2, and 3 with melting alloy or bi-metallic overload relays; also available as reversing contactors—*Square D Co.,* 4041 *N. Richards St., Milwaukee* 12, *Wis.*

Temperature Indicating Labels . . .

. . . for temperature detection and non-reversible indication up to 1100 F, consist of adhesive backed strips with pastel markings that turn black when predetermined temperature is reached; designed for detection of hazardous excess temperatures, labels adhere to surfaces until intentionally removed—*Pyrodyne, Inc.,* 11973 *San Vincente Blvd., Los Angeles* 49, *Calif.*

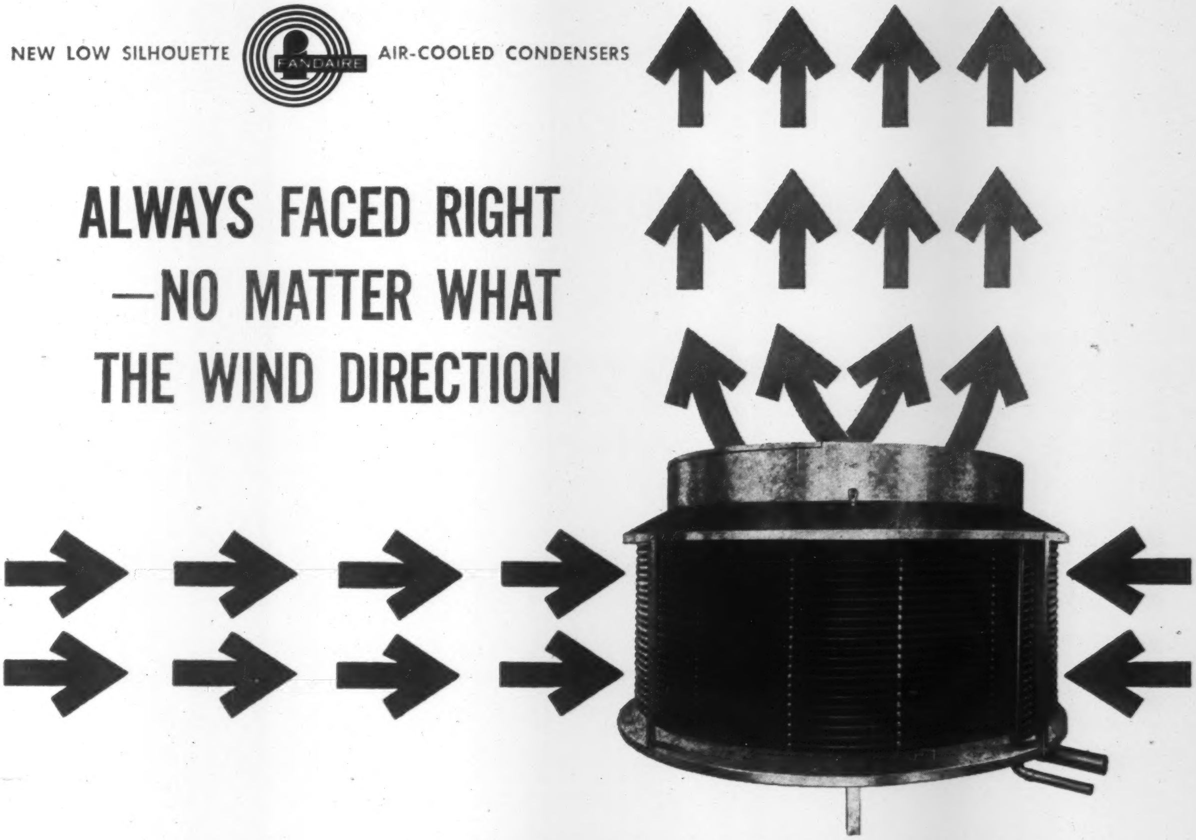


Corrosive Process Meter . . .

. . . for batching and process systems using corrosive liquids features automatic stop device; liquid quantity to be added is preset by pushbuttons, meter allows liquid to flow when valve is opened, shuts off automatically when limit is reached; capacity range of 20 to 100 gpm, of stainless steel construction, available with repeating auto-stop, ticket printer, or auto-switch control for actuation of pumps, valves, etc., after meter delivers mix—*Neptune Meter Co.,* 47-25 34*th St., Long Island City* 1, *N.Y.*

NEW LOW SILHOUETTE FANDAIRE AIR-COOLED CONDENSERS

ALWAYS FACED RIGHT —NO MATTER WHAT THE WIND DIRECTION



No need to position circular Fandaire Air-Cooled Condensers to meet prevailing winds. Just set it anywhere for easiest piping.

Exclusive Aimco fintube design provides high-heat dissipating efficiency for circular Fandaire condensers.

Here's the newest, most advanced air-cooled condenser on the market—Fandaire! This modern low silhouette condenser is engineered around a new high-heat dissipating fintube of exclusive design and manufacture. In operation, the entire spiral of fintubing is surrounded with a circle of swiftly moving cool air for highest cooling efficiency. Every degree in temperature drop is fully utilized as this circular design captures the wind from *any* direction, regardless of placement or location. A powerful fan pulls cool air in and pushes warm used air up and away. Fandaire's constant gravity tube drainage gives continuous movement to condensate.

With its low, clean-lined silhouette, Fandaire does not detract from the general architectural effect of the building. And weighing ⅓ less than conventional installations, the Fandaire usually can be positioned where needed, without guy wires or extra bracing. Savings in piping and installation alone may be considerable.

Where there is a problem of architectural compatibility, or of cost or performance, chances are the new Fandaire Air-Cooled Condenser is the best solution. Engineered in sizes from 3 to 120 tons per unit, there is a Fandaire model for practically all single or multiple installations. Get complete information today.

YUBA

specialists in circular air-cooled condensers

YUBA-AIMCO DIVISION
801 West 21st Street, Tulsa, Oklahoma

YUBA CONSOLIDATED INDUSTRIES, INC.

Sales Offices in Atlanta • Buffalo • Chicago • Cleveland • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • San Francisco • Seattle

1/4
3/4
If this Housing ever Breaks or Distorts we will replace it Free
RIDGID
HEAVY DUTY
D 14

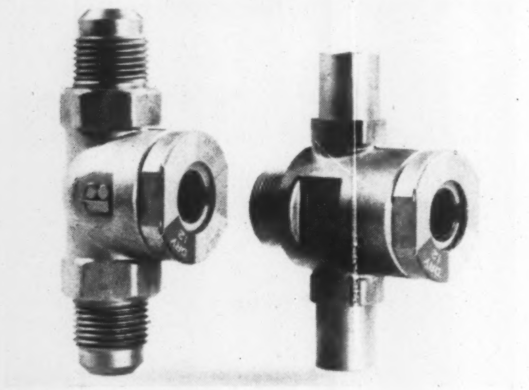
Skilled
Hands
Know the
Difference...

Genuine
RIDGID

At Your Supply House!
The Ridge Tool Company, Elyria, Ohio, U. S. A.

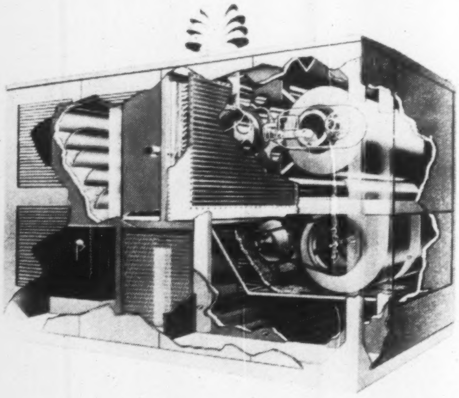
EQUIPMENT DEVELOPMENTS

Continued



Moisture Indicator . . .
. . . and sight glass combined in "T" or in-line models; one-piece indicator unit screws out of brass body to permit sweat connection soldering; available in all standard sizes, with flare or sweat connections—*Ansul Chemical Co., Marinette, Wis.*

Industrial Solvent . . .
. . . for cold-cleaning uses removes greases, oils, tars, waxes and other lubricating compounds; resists decomposition allowing economical repeated reclamation, according to manufacturer—*The Dow Chemical Co., Midland, Mich.*



Air Conditioning Unit . . .
. . . in six sizes for gas or oil firing in 150,000 to 1 million Btu output, designed to accommodate any standard make of cooling equipment from 2 to 40 tons with air or water-cooled condensing units; available as complete package or for later cooling addition, with enclosed housing, keylocked doors, two sets of dampers for air mixture from 100 percent outdoor to 100 percent return; designed for rooftop mounting—*The Mammoth Furnace Co., 6425 Cambridge Ave., Minneapolis, Minn.*

HOW TO SLEUTH OUT THE TRUTH ABOUT EXPANSION JOINTS

1 **Case the joint (design, that is)**

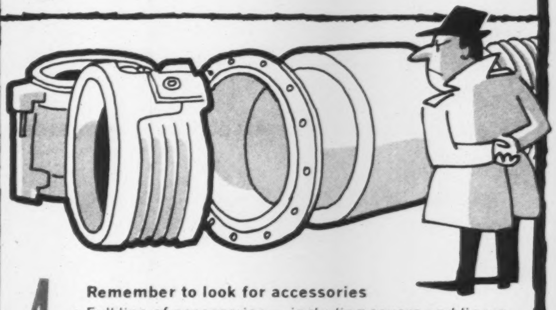
Badger S-R Expansion Joints have: 1. Corrugations which assume "all curve" shape under pressure — low stress, long life. 2. Tubular rings allow flexing over more of corrugation height.

2 **"Weigh" the evidence**

S-R Joints have no bulky castings . . . weigh up to 50% less . . . diameter equivalent to pipe flange. Installation is easier, lighter supports required.

3 **Search for clues in fabrication methods**

Bellows are hydraulically formed to produce uniform corrugations with minimum thinning of material. Quality controlled longitudinal welding, no multiple circumferential welds.



4 **Remember to look for accessories**

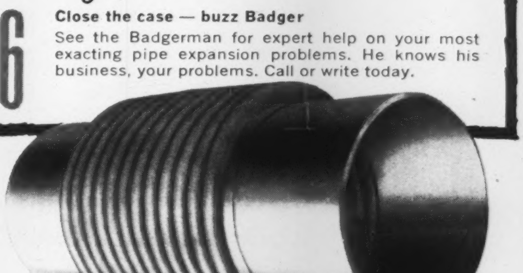
Full line of accessories — including covers and liners. Easy to pick proper combination of model, type and accessories for any pressure, temperature, erosive or corrosive condition.

5 **Pull an M.O. on the manufacturer's background**

Badger's 50-year experience includes development of first successful self-equalizing design for higher pressures, temperatures. Badger has had more fabrication and engineering experience in more different applications than any other manufacturer.

6 **Close the case — buzz Badger**

See the Badgerman for expert help on your most exacting pipe expansion problems. He knows his business, your problems. Call or write today.



BADGER S·R
Expansion Joints

BADGER MANUFACTURING COMPANY
230 Bent Street, Cambridge 41, Mass.
Representatives in Principal Cities

© 1960 BMC

NEW!

Now available at lower prices...

Proven METTLER Junior "Fan-Air" Gas Burners in capacities from 100,000 to 3,600,000 btu/hr

For low-cost, safe, efficient conversions, here are packaged burners you can't beat! Mettler's proven "Fan-Air" Burner efficiency is designed into compact, easily installed, fully automatic Junior units to permit lowest cost conversion of boilers, furnaces, and process heating equipment.

Multiple gas jets properly atomize fuel and mix with unrestricted air supply, provide clean, noiseless combustion — *and* fuel economy. Safe? You bet! Patented Mettler spark-ignited rectifier safety pilot and dependable electronic flame safety relay stand constant watch on flame failure.

Want full details? Before you specify or buy any burner, write us for your free copy of Bulletin G-100-B. Or contact your Mettler representative for complete information.

METTLER

Eclipse

THE METTLER CO., INC.
Division of
ECLIPSE FUEL ENGINEERING CO.
1101 Buchanan St., Rockford, Illinois

RECENT TRADE LITERATURE...

▶ *AIR FLOW REGULATOR*—specification sheet "101" available for boiler combustion control system unit which features large diaphragm, low current flow through contact points. *Coen Controls Co., Inc., 40 Boardman Place, San Francisco 3, Calif.*

▶ *ALUMINUM EXTRUSIONS*—bulletin "14" describes role in peacetime atomic research at Argonne National Laboratory. *Precision Extrusions, Inc., 720 E. Green Ave., Bensenville, Ill.*

▶ *ARC WELDERS*—described and illustrated in new bulletin which covers 40 available models. *Miller Electric Mfg. Co., Inc., 718 S. Bounds St., Appleton, Wis.*

▶ *BALL BEARINGS*—of thin-sectioned, large bore design for commercial and industrial requirements described in bulletin "S-112R", including specifications, prices, installation drawings for ¼ to 1 in. wide, 4 to 12 in. diameter bearings in six series, 90 standard sizes. *The Kaydon Engineering Corp., McCraken St., Muskegon, Mich.*

▶ *BONDING CHART*—gives information and specifications on types of adhesives for insulation projects; cross-indexed, chart covers wide variety of insulation material and base materials, plus line of anchors and insulation clips. *Miracle Adhesives Corp., 250 Pettit Ave., Bellmore, L.I., N.Y.*

▶ *CRYOGENICS SYSTEMS*—bellows-type expansion joints, couplings, and plastic structures described in brochure "F". *Uni-Flex Mfg. & Engineering, Inc., 5545 East Slauson, Los Angeles 22, Calif.*

A New Kind of Paper
That Helps Stop Fires
Before They Start

The bill is higher than ever today when fire interrupts production. That is why architects, engineers and building management think in terms of "total fireproofness". A requirement of this concept is the scrutiny of every element of construction as to its flammability.

An additional contribution to "total fireproofness" has been made with the development of Pyro-Kure® vapor barriers. These U/L rated products (used in construction to eliminate condensation damage) employ paper, foil or plastic film laminations. The special adhesive used emits a gas at combustion temperature which snuffs out the flame making the product self extinguishing.

Pyro-Kure vapor barriers are unique in being *permanently* non-combustible. They have a perm rating of less than 0.1 and are being used as insulation facing, pipe jacketing and duct lining. Leading insulation manufacturers are combining them with their products. Write Dept. AS2 for technical literature and samples on this vapor barrier line.

SISALKRAFT

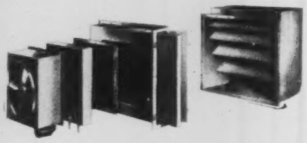
AMERICAN SISALKRAFT CORPORATION
Chicago 6 • New York 17 • San Francisco 5
In Canada: Murray-Brantford Ltd., Montreal

reinforced paper, foil and plastics for construction, industrial packaging and agriculture

Comfort year 'round
in any climate with
Aerovent
Air Make-Up Units

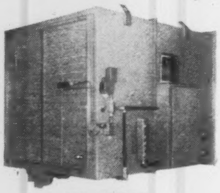
Your best investment in modern air-handling equipment! New Aerovent Air Make-Up Units provide clean, fresh air in winter or summer; help maintain uniform temperature levels throughout working areas. Used as filtered-air supply units or air preheaters, these versatile units permit heating and ventilating systems to operate at design efficiency; equalize negative pressures by replacing exhaust air.

Steam, hot water or gas-fired models in sizes 18" to 54" (larger units available on order) for capacities, pressure conditions and BTU ratings to suit your requirements. Compact, packaged design for roof or wall mounting. Other assemblies also supplied for exclusive use in air supply or air heater applications. Why not investigate the many advantages of these high-efficiency units, today?



STEAM OR HOT WATER

Furnished in 7 unit arrangements in sizes 24" to 54". Capacities from 5,000 to 35,000 CFM. Roof or wall types for all requirements.



GAS-FIRED

Supplied in 4 unit arrangements for roof or wall mounting. Sizes 36" to 54" for various capacities, BTU ratings and pressure conditions.

Write for new Bulletin 880

Air deliveries of all Aerovent equipment are tested and rated in accordance with established and accepted codes and each unit is guaranteed by the manufacturer to deliver its rated performance.

CERTIFIED PERFORMANCE

Aerovent FAN COMPANY, INC.
Ash and Branch Streets
Piqua, Ohio

RECENT TRADE LITERATURE

Continued

▶ *DIAPHRAGM BELLOWS*—design guide describes welded type, with drawings and specifications, plus illustrations of flexible, expansion, and pressure types; includes discussion of formed and welded bellows. *Breeze Corporations, Inc., 700 Liberty Ave., Union, N.J.*

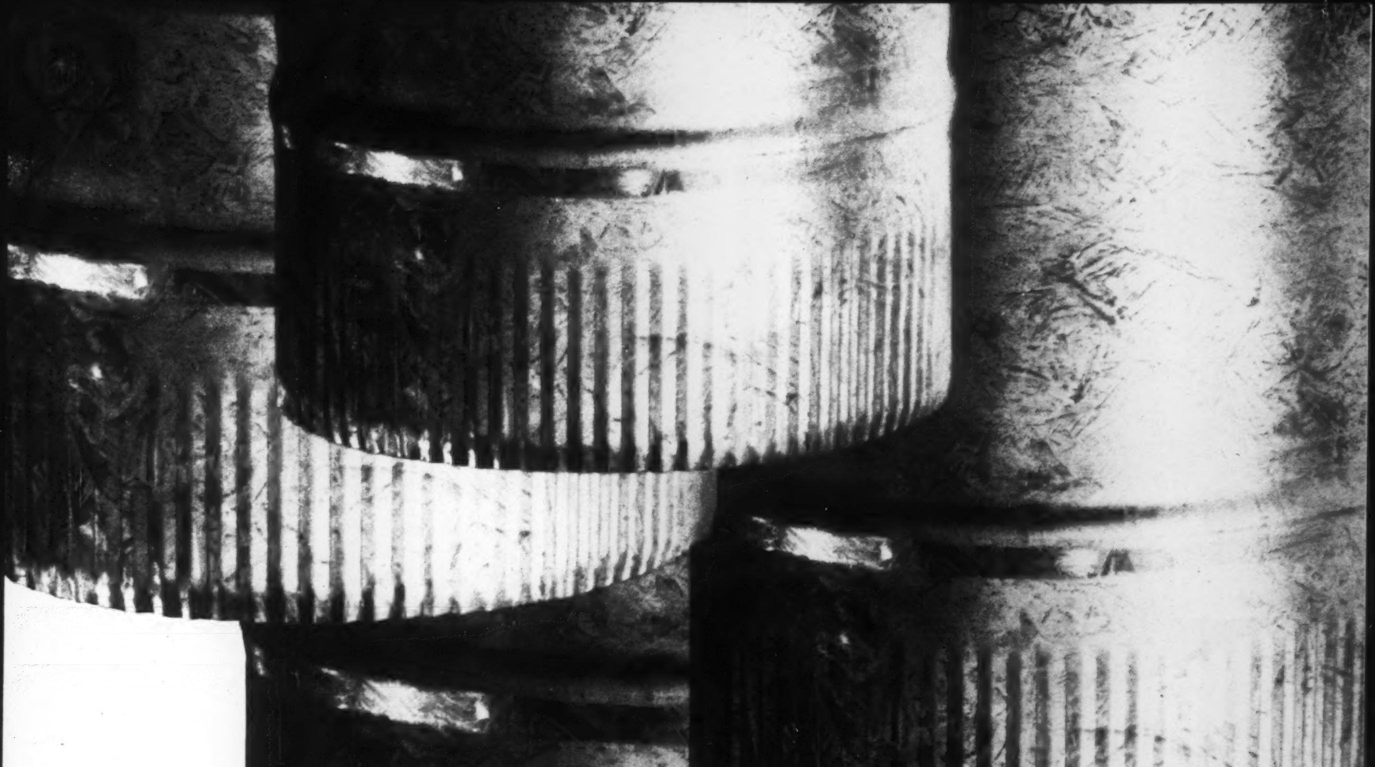
▶ *DUCT INSULATION*—glass fiber, in 1 to 2 in. thick, 24, 36, 48, in. wide blankets described in brochure "IN-285A" with illustrations of standard application methods, lists available moisture barrier materials. *Johns-Manville, 22 East 40th St., New York 16, N.Y.*

▶ *DUST COLLECTORS*—*bulletin* "1928" describes new series available, lists advantages claimed for large tube design, discusses design and construction principles; with cutaway illustration, selection and efficiency rating nomograms. *American-Standard Industrial Division, Detroit 32, Mich.*

▶ *ECCENTRIC VALVES*—bulletin "110" lists features, materials, pressure ratings, dimensions, and accessories, describes areas of application. *DeZurik Corp., Sartell, Minn.*

▶ *ELECTRO-MECHANICAL COMPONENTS*—for use in measuring, indicating, recording, and control applications described in brochure "SE-60" with application diagrams and performance curves. *Shaevitz Engineering, P.O. Box 505, Camden 1, N.J.*

▶ *FASTENING TOOLS*—powder actuated, detailed in catalog "B-141" which gives data on working loads, description of operating principle employed in units which utilize energy of fired blank cartridges. *Ramset Fastening Systems, Olin Mathieson Chemical Corp., 460 Park Ave., New York 22, N.Y.*



The more crimping you have to do, the more satisfied you will be with Weirkote Zinc-Coated Steel. There's no peeling, no chipping, no flaking. Work it to the limits of the steel base itself and the zinc coating remains intact assuring you of the complete corrosion protection that only zinc can give. Weirkote is made that way—to retain its protective zinc coating no matter how tough the forming and bending operations. A Weirton representative will gladly supply full information on Weirkote—another fine product of the Weirton Steel Company, Weirton, West Virginia.

WEIRTON STEEL
Weirton, West Virginia

Weirton Steel is a division of **NATIONAL STEEL CORPORATION**
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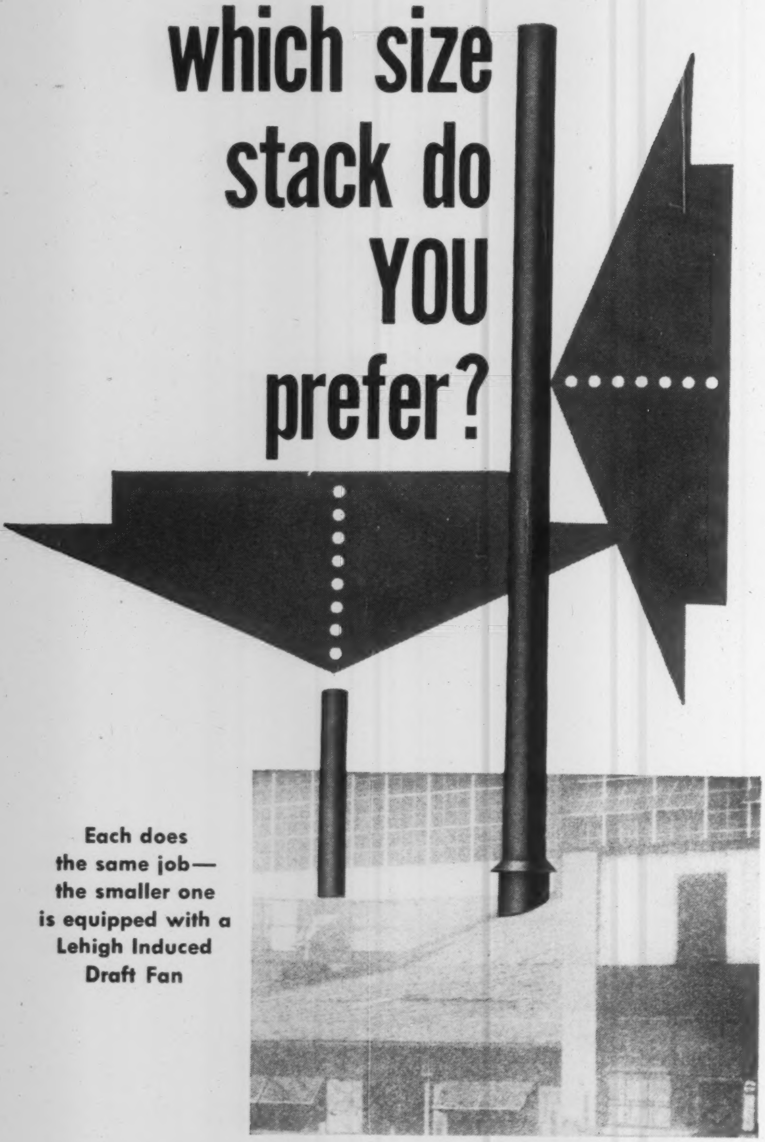

which size stack do YOU prefer?

Each does the same job—the smaller one is equipped with a Lehigh Induced Draft Fan

Lehigh Induced Draft Fans are designed to help eliminate large, costly, unsightly stacks. They maintain a *constant* over-fire draft regardless of atmospheric conditions, help keep boilers operating at *maximum* efficiently at all times, and significantly *lower fuel bills* . . . while radically *reducing* the size of your stack.

Rugged Construction—long life: to prevent distortion under elevated temperature conditions, the fan housing, bearing pedestal, motor support and fan wheel of Lehigh Draft Induced Fans are constructed of all-welded integral $\frac{3}{16}$" mild steel. A radiant heat cover and an aluminum heat flinger protect the inboard bearing from radiated heat. And because both bearing and shaft are kept to a low operating temperature, the Lehigh Induced Draft Fan makes use of standard, self-aligning ball bearing pillow blocks. *All* Lehigh Induced Draft Fans feature a flanged inlet, flanged outlet, and inspection cover as standard equipment.

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2171
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FULLER COMPANY, CATASAUQUA 1, PA.
Subsidiary of General American Transportation Corporation

LEHIGH

RECENT TRADE LITERATURE

Continued

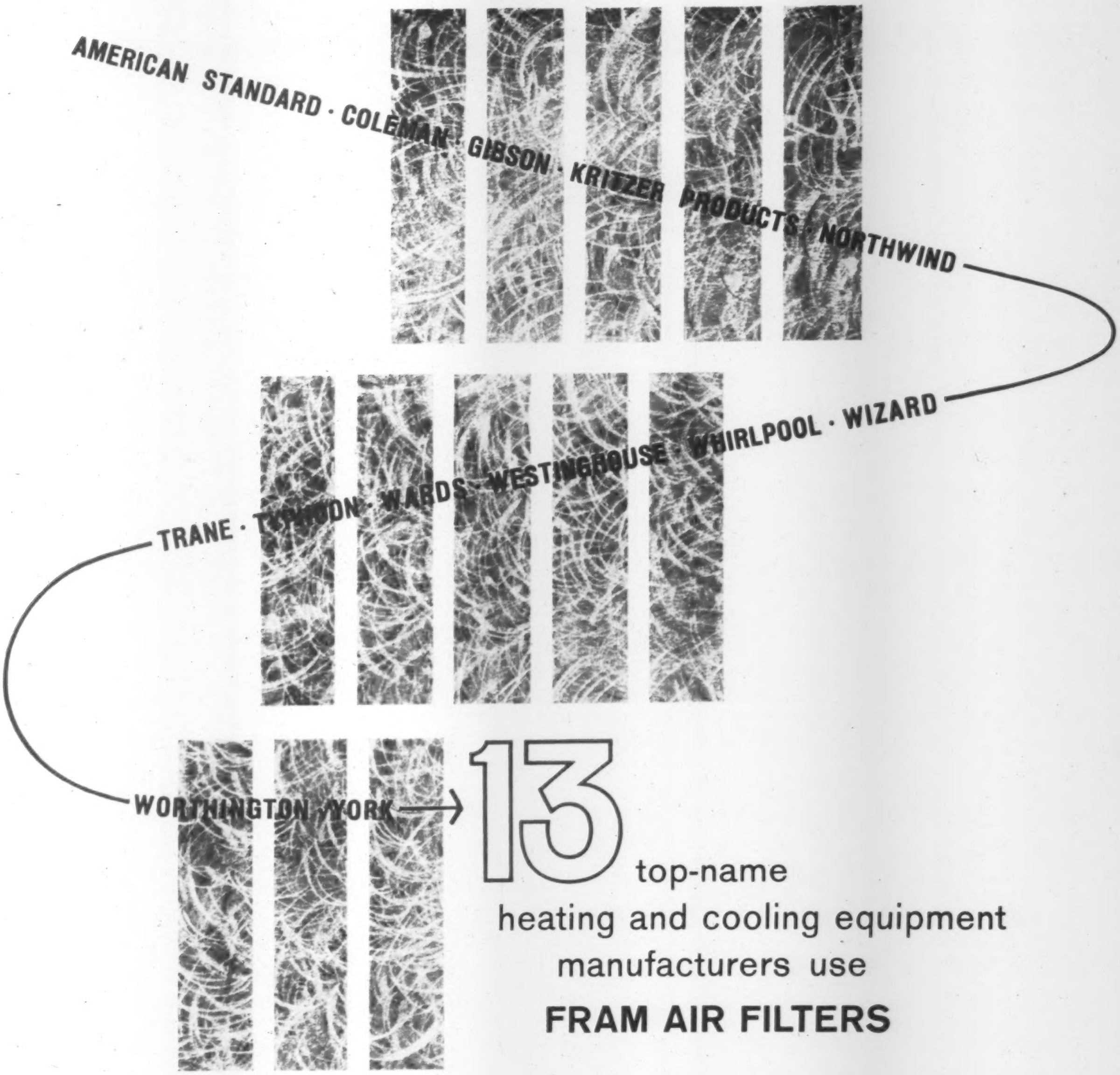
▶ *FLEXIBLE DUCT CONNECTORS*—and other sheet metal specialties including damper regulators, blade kits, vane rail, sheet metal self-drilling screws and new adhesive detailed in new brochure. *Duro-Dyne Corp., Route* 110, *Farmingdale, L.I., N.Y.*

▶ *FLEXIBLE DUCTS*—for air conditioning uses described in new manual which gives details of construction for types available, with flexibility characteristics. *Flexible Tubing Corp., Guilford* 2, *Conn.*

▶ *FLOW METERS*—remote-reading, electrical for liquids and gases at pressures to 5000 psi described in bulletin "59-5" with illustrations, typical electrical circuits, flow charts, piping and boiler arrangements, piping requirements for orifices, flow nozzles and venturi tubes. *Republic Flow Meters Co.,* 2240 *Diversey Pkwy., Chicago* 47, *Ill.*

▶ *FLOW TUBES*—weldment type for metering liquids, steam, other fluids at high or low pressures and temperatures, in sizes from 1 to over 120 in., variety of materials, described in bulletin "0115.20-3" with drawings of 10 different styles, engineering and ordering data. *B-I-F Industries, Inc., P.O. Box* 1342, *Providence* 1, *R.I.*

▶ *FLUID DRIVES*—for power transmission featured in bulletin "A-719" which discusses principles of operation, illustrates typical applications: with hp and inertia starting capacity curves, explanation of components, selection charts for variable and constant torque units, dimensional data, ordering requirements, and list of auxiliaries. *American-Standard Industrial Division, Detroit* 32, *Mich.*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Reason: Revolutionary Permachem-treated Celanese fibers keep air hospital clean, lengthen filter life

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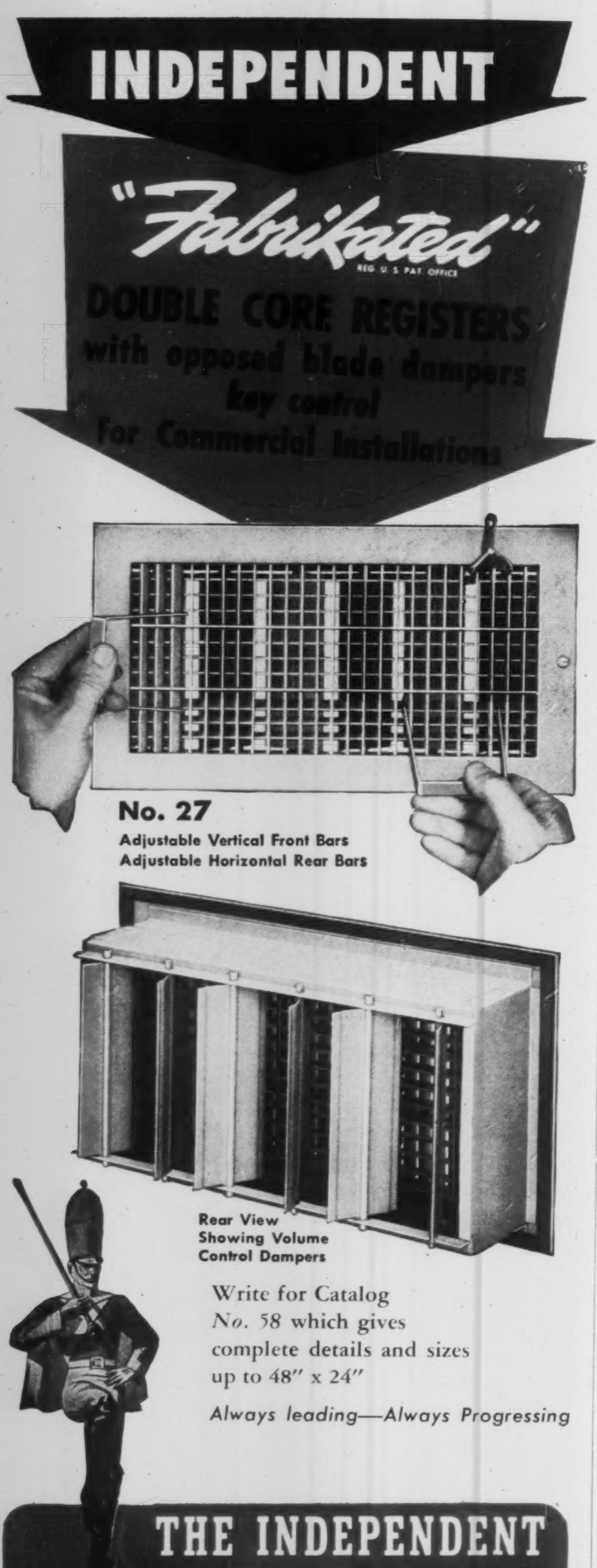

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For Commercial Installations

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up to 48" x 24"

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RECENT TRADE LITERATURE

Continued

▶ *FUME SCRUBBER*—covered in bulletin "W-8560" which presents comprehensive description of design and operational features of unit said to provide high efficiency in submicron range with small size by means of adjustable orifice; with dimensions, pressure drop vs water rate curves, installation sketches and performance results in several installations. *The Ducon Co., Inc., 147 E. Second St., Mineola, L.I., N.Y.*

▶ *GAS BURNER*—bulletin "GC 571-M8" explains mechanics, operation, and installation of new power unit with electric ignition system for 75,000 to 250,000 Btu per hr input range with all gases; with illustrations. *Lennox Industries Inc., PR Department, Marshalltown, Ia.*

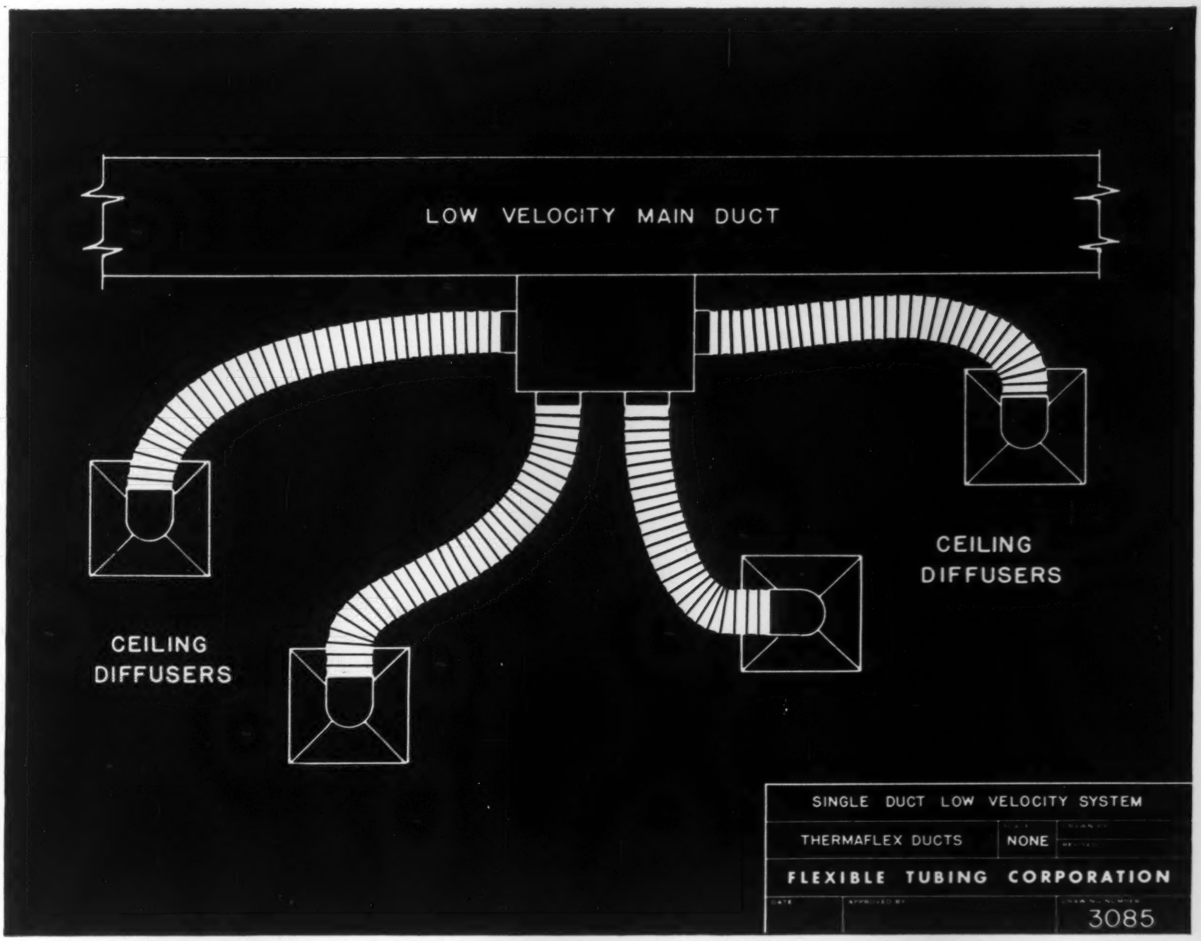
▶ *HEATER COIL FREEZING*—and how to prevent it is subject of new bulletin "T503" which discusses factors leading to freeze-up, provides chart for determining freezing danger point, describes hook-ups to overcome freezing conditions. *Sarco Co., Inc., 635 Madison Ave., New York 22, N.Y.*

▶ *HEATING AND COOLING CONTROLS*—new manual is intended as guide in selection of automatic units; contains examples, workable systems, covers applications such as fuel oil heaters, heat exchangers, process hot water, pressure reducing, two-temperature hot water systems, others, plus lists of additional literature available. *The Powers Regulator Co., 3434 Oakton St., Skokie, Ill.*

▶ *HEATING COILS*—for steam, steam distribution, and hot water described in bulletin which presents materials and construction details, layout drawings; tabulated dimensional data, discussion of coil selection, rating curves, condensate rating information for saturated and superheated steam and presents typical material specification for coil applications involving factors which exceed standard construction limits. *American-Standard Industrial Division, Detroit 32, Mich.*

▶ *HEAT EXCHANGER*—catalog binder contains 13 separate bulletins describing line of shell and tube units; in four sections: coolers, heaters, heat exchangers, and general data; available on company letterhead request only. *American-Standard Industrial Division, Detroit 32, Mich.*

▶ *HOT WATER GENERATORS*—which employ forced recirculation to permit temperature differentials to 200 F or more between outlet and return water are detailed in bulletin "1600" with boiler diagrams, photographs of installations, engineering data section with flow rate and heat content tables. *The International Boiler Works Co., 168 Maple St., East Stroudsburg, Pa.*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CEILING DIFFUSERS
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Where multiple run-outs are required...

Flexible Tubing simplifies connections to diffusers...gives you greater design flexibility

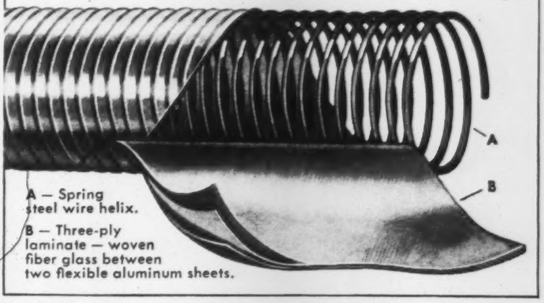
Flexible Tubing is the fast, easy way to connect supply ducts to diffusers. It's particularly helpful in low- and high-velocity systems that require multiple runouts.

This highly flexible duct is perfect for installations where changing space requirements will mean frequent relocation of partitions. Flexible Tubing permits diffusers to be moved *without being disconnected* — the ductwork simply trails behind!

Flexible Tubing goes over obstructions, through tight passages — even around sharp corners — in gradual, gentle bends with minimum air flow loss. It greatly reduces mechanical noises due to vibration . . . corrects for misalignments at points of take-off. What's more, Flexible Tubing is lightweight, rugged, flameproof!

For greatest design flexibility, specify Thermaflex® for your next system. For complete data on Underwriters'-approved Thermaflex, write Flexible Tubing Corporation, 56 New Whitfield Street, Guilford, Connecticut.

See why Thermaflex-A is so flexible and long-wearing!



A — Spring steel wire helix.

B — Three-ply laminate — woven fiber glass between two flexible aluminum sheets.

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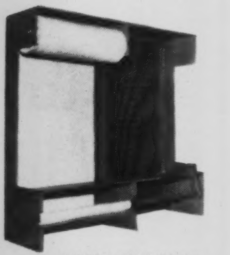
NEW
Micromat®
SYSTEM OF AIR FILTRATION

Large
Industrial panel
filter installation.

NOW — tailor air filters to job requirements - economically!

A *new concept* in air purification, MICROMAT offers not one but *nine* separate filter media, each with specific capabilities. Used singly or in combination, there is a low-cost MICROMAT medium to meet virtually *any* set of specifications for efficiency and air flow. Thus the MICROMAT System, with a *choice* of media, provides the means of tailoring air filtration to your exact requirements.



MICROMATIC Roll Filter
Machine — automatic, semi-auto., or manual operation

Efficiency Range — 5% to 85%

MICROMAT Replaceable Media are made from various types of non-woven synthetic fibers. Their natural filtering properties eliminate any need for viscous coating, yet MICROMAT media efficiencies range from 5% to 85% (using Discoloration Test procedures).

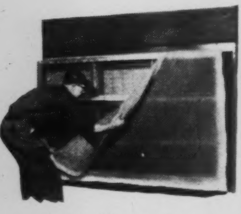
Cut Maintenance Costs

MICROMAT filters are easy to maintain . . . and normally afford worthwhile savings in handling, changing, and storage space when compared to permanent, washable filters and other replaceable types. Versatile in use, MICROMAT media are readily adaptable to panel (frame), blanket, or roll machine installation.

MICROMAT Outperforms Conventional Filters

Present users have found that, at any given air velocity, the right MICROMAT medium will outperform conventional filters and deliver cleaner air at lower overall cost.

For complete technical information on the MICROMAT System of Air Filtration, write for FREE brochure on your company letterhead.



BLANKET Filtration
eliminates frames, increases
capacity 12-15%.

(Where a washable, permanent filter is required, Microtron Corp. offers new MICRO-FOAM, a superior, acid and base resistant, plastic foam material with wide range of efficiencies and high dirt-loading characteristics.)

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102 Main St. S., Weston, Toronto 15, Ont.

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RECENT TRADE LITERATURE

Continued

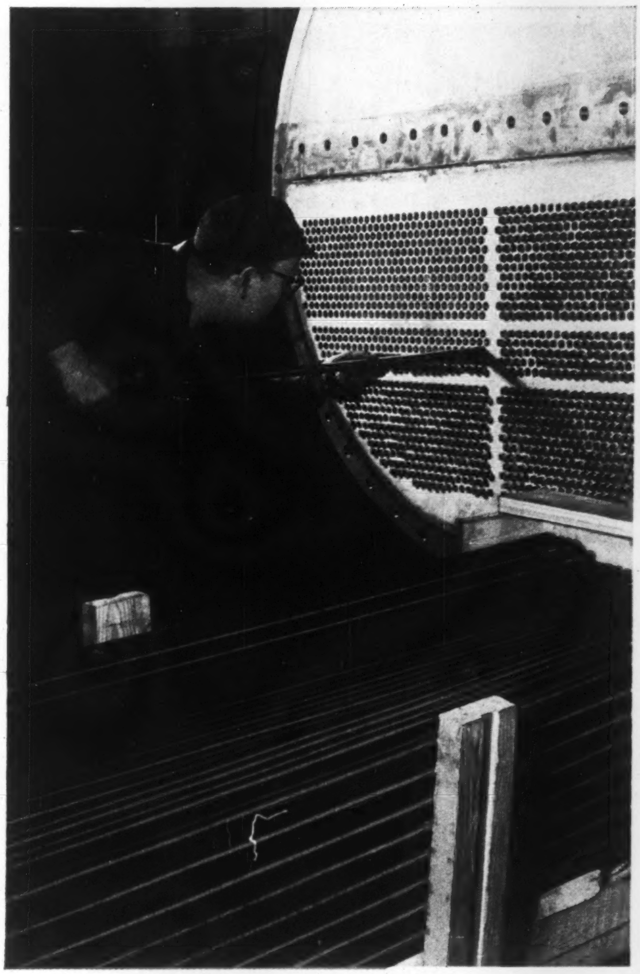
▶ *HOT WATER HEATERS*—for commercial and industrial installations in nine models with 180,000 to 1,800,000 Btu per hr input covered in new folder with cut-away drawings of fire tube construction, water leg and integrated burner design, description of nickel lining process said to afford high corrosion resistance and to prohibit scaling. *Commercial Heater Co., 3020 Galvez, Fort Worth 11, Texas.*

▶ *HYDRAULIC HOSE*—couplings and fittings presented on wall chart with illustrations, dimensions, etc, combines with catalog "D-1" which gives detailed data, specifications and instructions for on the job replacement. *Anchor Coupling Co., Inc., 342 N. Fourth St., Libertyville, Ill.*

▶ *INDUCTION MOTORS*—selection, application, and buying guide for single and three-phase, 3/4 to 150 hp units presented in bulletin "GEC-1049" with dimensions, prices, performance data, ordering instructions, modifications and accessories, plus typical ratings and illustrations of construction features. *General Electric Co., 1 River Rd., Schenectady 5, N.Y.*

▶ *INDUSTRIAL FANS*—bulletin "IF-100" includes section of engineering data on industrial exhausting, blowing and drying, with air volume tables, corrosion data, drying temperatures for processing requirements, piping information, plus data on line of fans in 17 wheel sizes, with capacity tables for 270 to 48,000 cfm units. *General Blower Co., 8610 Ferris Ave., Morton Grove, Ill.*

▶ *INDUSTRIAL INSULATIONS*—of spun mineral wool, calcium silicate, 85 percent magnesia, in block, blanket, felt, fill, cement, and pipe forms described and illustrated with data on thermal conductivity, recommended thicknesses, application



York counts on WOLVERINE TRUFIN® for Quality and Maximum Heat Transfer

In Atlanta, Ga., customers of Rich's Department Store shop in air conditioned comfort—thanks to air conditioning equipment manufactured by York Division of Borg-Warner Corporation, York, Pennsylvania.

And, like countless other air conditioning installations made each year by York, this one too, uses integrally finned Wolverine Trufin Type S/T condenser tubes in its heat exchangers.

Of Wolverine Trufin and its ability to increase heat transfer capacity, York engineers say, "Quality materials are as necessary as the skilled workmanship that goes into every York product. We find that Wolverine Trufin's extended surface gives us a good ratio of inside to outside heat transfer. It permits the maximum amount of heat transfer with a minimum of space while maintaining outstanding dependability."

If your company requires nonferrous tubing for heat transfer—or any other purpose—talk to Wolverine Tube before placing your next order. Like York Division you'll find the kind of quality and dependability that meets your highest expectations. Write, too, for your copy of the Wolverine Tubemanship Book.

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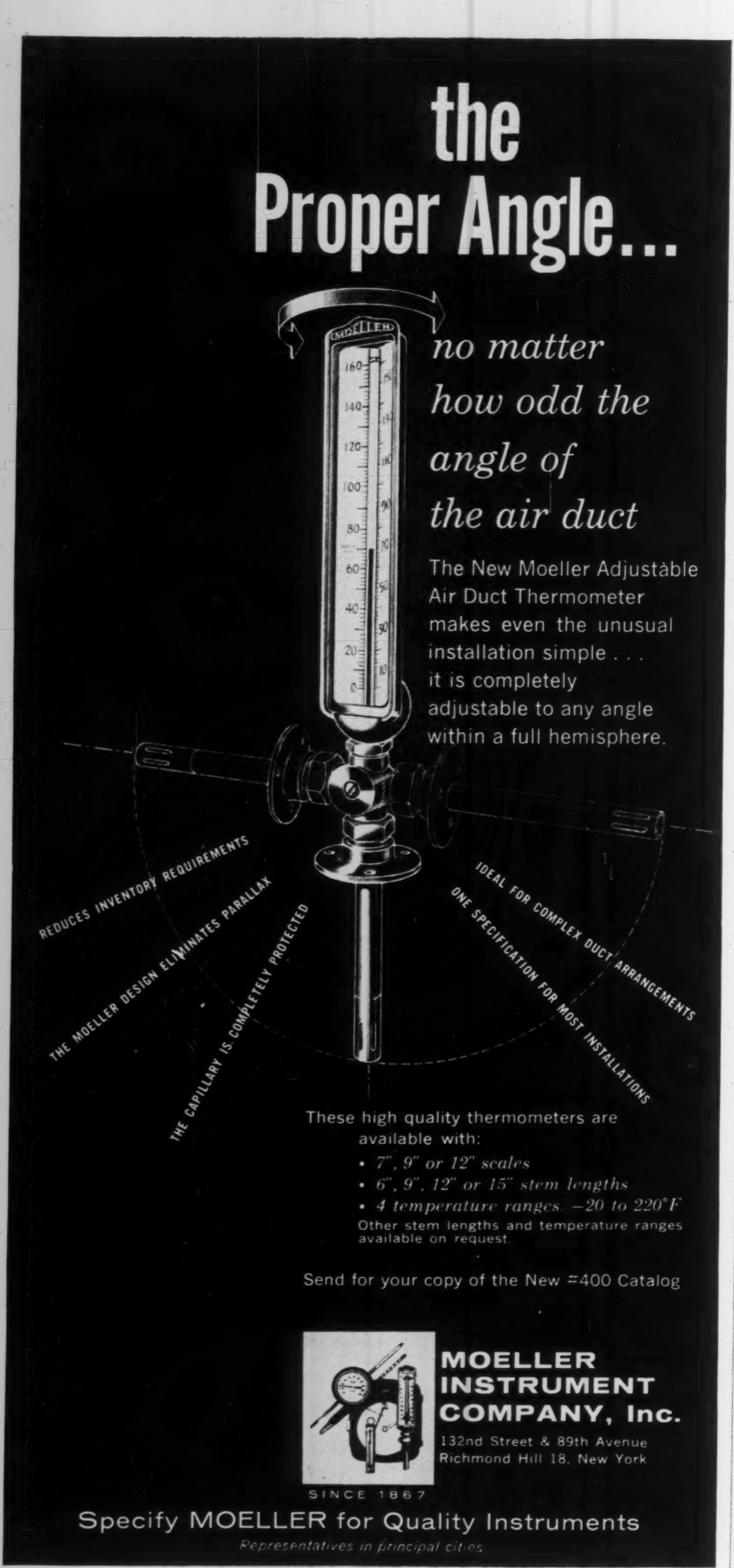
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THE MOELLER DESIGN ELIMINATES PARALLAX
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IDEAL FOR COMPLEX DUCT ARRANGEMENTS
ONE SPECIFICATION FOR MOST INSTALLATIONS
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the Proper Angle...

no matter how odd the angle of the air duct

The New Moeller Adjustable Air Duct Thermometer makes even the unusual installation simple . . . it is completely adjustable to any angle within a full hemisphere.

These high quality thermometers are available with:

- *7", 9" or 12" scales*
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- *4 temperature ranges, −20 to 220°F*

Other stem lengths and temperature ranges available on request.

Send for your copy of the New #400 Catalog

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RECENT TRADE LITERATURE

Continued

instructions, and selection chart included in new catalog. *Baldwin-Ehret-Hill, Inc., 500 Breunig Ave., Trenton 2, N.J.*

▶ *MACHINERY MOUNTS*—for leveling and vibration isolation applications featured in bulletins "59-04.5" and "60-04" with illustrations of construction features, applications. *Barry Controls, Inc., 700 Pleasant St., Watertown 72, Mass.*

▶ *MOTOR CONTROLLERS*—three specification sheets "S801-4," "S801-5," and "S801-6" give details on units for position-proportioning control of motors or other actuators, time proportioning control of on-off final control elements such as contactors, and solenoid valves, and current-proportioning control of electric heaters. *Minneapolis-Honeywell Regulator Co., Wayne and Windrim Avenues, Philadelphia 44, Pa.*

▶ *MOTOR OPERATORS*—and motorized valves described in catalog "407" including reversible, proportional unit with instant braking for instrumentation and control application. *Schade Valve Mfg. Co., 2527 N. Bodine St., Philadelphia 33, Pa.*

▶ *PACKAGED AIR CONDITIONERS*—in single and multi-zone designs described and illustrated in bulletin "8625" with line drawings used to illustrate available arrangements and location of basic elements, itemization of design features, basic specifications and dimensions; units are 25, 30, and 40 ton models. *American-Standard Industrial Division, Detroit 32, Mich.*

▶ *PACKAGED BURNER*—combination gas and oil type for boilers in 50,000 to 100,000 lb of steam per hr size range described in bulletin "FC-60" with description of design features said to reduce nuisance shutdowns. *Coen Co., Inc., 40 Boardman Place, San Francisco 3, Calif.*

You get these benefits when you install YARWAY GUN-PAKT EXPANSION JOINTS

Why do industrial plants, institutions, universities and central heating plants SPECIFY and INSTALL Yarway Gun-Pakt Expansion Joints?

Because with Yarway you get:

- **CONTINUOUS SERVICE**
  Costly shutdowns are eliminated. Packing is seldom necessary but may be added *under full line pressure.* No vents are necessary. Never needs repacking.
- **RUGGED DEPENDABILITY ALL STEEL CONSTRUCTION**
  Durable chromium plated seamless steel sleeves. No chance *of metal fatigue.* Wrought steel bases provide rugged, positive anchorage.
- **INTERNAL AND EXTERNAL GUIDES**
  Positive alignment of sleeve in stuffing box *—where it counts!*
- **LIGHT WEIGHT, STREAMLINED DESIGN**
  Requires less space to install—less space to maintain—smaller manholes.

Many Gun-Pakt joints have been *in service over 25 years with only nominal maintenance*—no major repairs or periodic overhauls. Maintenance costs are negligible—records show average to be one manhour and 65 cents worth of packing per joint per year. AND—NEVER A SHUTDOWN FOR REPACKING!

YARWAY field engineers are qualified to advise on installation and service—at no cost to you. Investigate today. Write for Bulletin EJ 1917 ('59).

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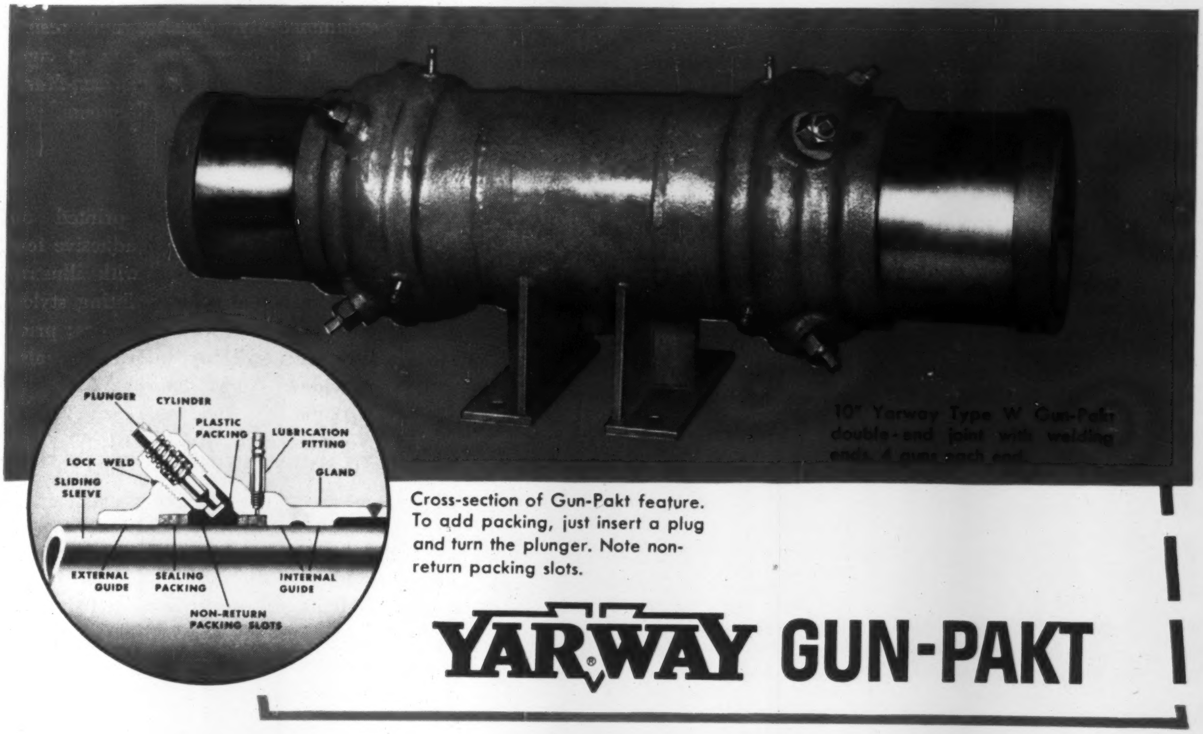
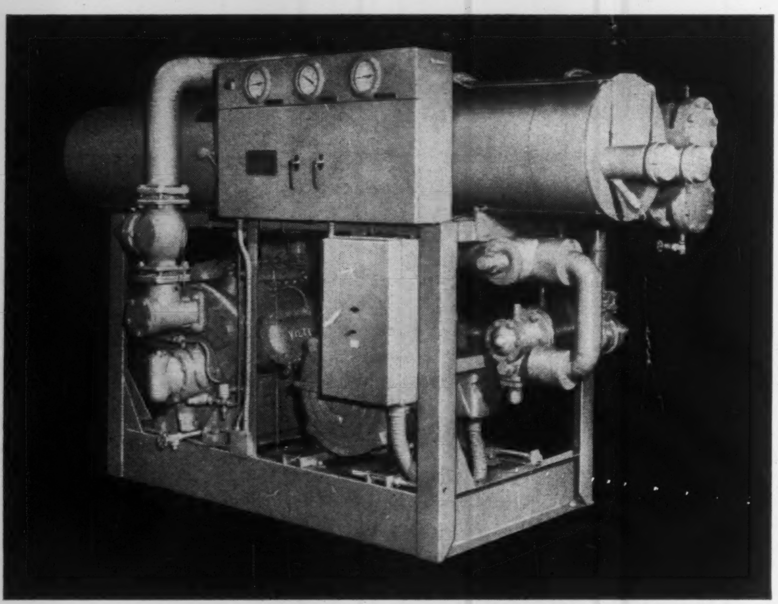


10" Yarway Type W Gun-Pakt double-end joint with welding ends. 4 guns each end.

Cross-section of Gun-Pakt feature. To add packing, just insert a plug and turn the plunger. Note non-return packing slots.

YARWAY® GUN-PAKT

Air-conditioning made easy with new space-saving fully flooded Vilter Chiller



View of the new Vilter Flooded Uni-Chiller—100-ton nominal capacity.

Compact, space-saving design, low cost and a flooded water chiller are some of the important advantages of the new Vilter flooded type Uni-Chiller.

While especially suited for air conditioning applications, Uni-Chillers fit readily into almost any liquid chilling system.

Four standard sizes are offered—25, 50, 75 and 100-ton nominal capacities.

All components are sized to operate efficiently as a system. The flooded-type shell and tube cooler and the condenser are mounted above a rugged Vilter VMC compressor. Shipped assembled, the Uni-Chiller arrives with all interconnecting piping completed, controls factory wired, cooler and low-temperature piping insulated and a holding charge of refrigerant.

Motor and starter can also be supplied by Vilter and if desired, the compressor and motor can be run-in and all controls and gauges properly adjusted and set. By specifying a completely assembled unit, installation costs and start-up time are reduced . . . real savings to you.

Why not contact your nearest Vilter representative or write directly to Vilter for full details and application recommendations.

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Air Units • Ammonia and Freon Compressors • Booster Compressors Baudelot Coolers • Water and Brine Coolers • Blast Freezers Evaporative and Shell and Tube Condensers • Pipe Coils Valves and Fittings • Pakice and Polarflake Ice machines.

We will be pleased to send you complete details on the above equipment.

Write Vilter Dept. F-913

RECENT TRADE LITERATURE

Continued

▶ *PIPE BENDING*—discussed in bulletin "260" which covers subjects such as calculating length of legs, locating the bend, back-to-back method, back-to-back push through method, offset method; with description of features of line of benders available. *Lidseen of North Carolina, Inc., 1133 First St., Hayesville, N. C.*

▶ *PIPE INSULATION*—for low temperature service said to cover range between absolute zero and 250 F discussed in bulletin which presents data on thermal conductivity of polyurethane foam material, its workability, mechanical strength, thermal shock, flame vapor, and chemical resistance; with recommended thicknesses, illustrated application instructions. *Baldwin-Ehret-Hill, Inc., 500 Breunig Ave., Trenton 2, N. J.*

▶ *PIPE INSULATION*—of expanded synthetic material described in folder which explains characteristics that allow for condensation stoppage, reduction of heat loss, water tightness and resistance to oil, acid and alkaline substances; with data on weight, inflammability, density, and resistance to deterioration due to age. *Presstite Division, American-Marietta Co., 39th and Chouteau, St. Louis, Mo.*

▶ *PIPE MARKERS*—printed on vinyl cloth backed with adhesive featured in new catalog with illustrations in actual color, printing styles, and correlation with pipe sizes; price lists and ordering information also provided. *North Shore Nameplate, Division of Anodyne, Inc., 214-27 Northern Blvd., Bayside 61, N. Y.*

▶ *PIPE UNIONS*—and swing check valves featured in catalog "60" with complete engineering data, sizes, weights and dimensions including illustration of convertibility feature which allows insertion of orifice plate in standard union as economy meas-

THE CASE OF THE A. O. SMITH MOTOR MAN

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ALWAYS RARIN' TO GO!

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...the complete story of these 800 to 1 hp favorites and their winning ways in the toughest going

Long-life service, low maintenance and quiet operation are qualities that have been bred into the A. O. Smith line. That's why they're the *go* motors — the integrals you can depend upon when the going gets tough. You can hitch your application to single-phase models (1-5 hp) or polyphase (1-800 hp). Also a full line of fractional-hp motors.

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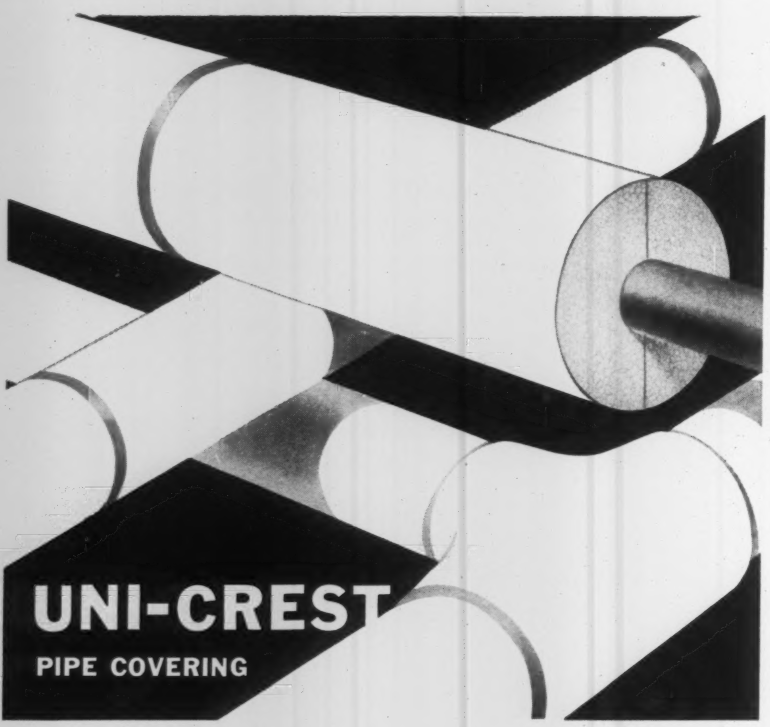

a new, economical, low temperature insulation

Uni-Crest expanded polystyrene pipe covering is an excellent low temperature insulating material, and is inexpensive to install and maintain.

Its low thermal conductivity (K factor) plus its high resistance to water and water vapor — are some of its prime qualities. It will not rot, mildew, or support fungus growth.

Extremely lightweight, with a smooth, tough white surface, Uni-Crest is non-dusting, non-flaking, and easily cut and handled on the job.

Uni-Crest and self-extinguishing Uni-Crest are available in a wide variety of sizes and shapes. Both types are also available with or without a paper and foil laminate jacket.

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BRANCH OFFICES OR APPROVED DISTRIBUTORS IN ALL KEY CITIES

RECENT TRADE LITERATURE

Continued

ure; catalog includes first-time information on gasketless cup orifice unions, and ductile iron check valves. *Catawissa Valve & Fittings Co., Catawissa, Pa.*

▸ *PIPE AND TUBING CUTTERS*—of circular abrasive saw type featured in catalog which discusses advantages of "machine cutting" for accurate sizing, clean ends. *Wallace Supplies Mfg. Co., 1304 West Diversey, Chicago 14, Ill.*

▸ *PLASTIC FITTINGS*—and fabrications detailed in folder with information on material available, exhaust and process systems applications, dimensional and specification data. *Argo Plastic Products Co., P. O. Box 3541, Cleveland 18, O.*

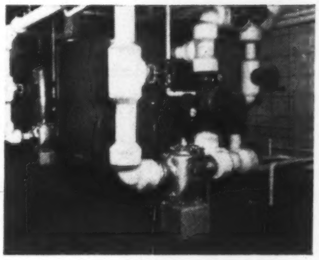
▸ *PLASTIC FITTINGS*—brochure describes and illustrates line of fittings including nylon or styrene copolymer inserts and SWP fittings in complete size ranges; folder includes list prices. *Industrial Plastic Fittings Div., R & K Plastic Industries Co., 11 W. Pennsylvania Ave., Towson 4, Md.*

▸ *PORTABLE BOILERS*—from 20 to 200 hp for variety of applications requiring steam or hot water service described in bulletin "4011" with drawings of possible applications, brief specifications. *Vapor Heating Corp., 80 E. Jackson Blvd., Chicago 4, Ill.*

▸ *PORTABLE CHLORINATOR*—data sheet "D-60-1" describes use by food processing plant to combat water contamination; dosages may be regulated three ways, unit said to maintain chlorine range of 0.2 to 0.5 ppm. *Milton Roy Co., 1300 E. Mermaid Lane, Philadelphia 18, Pa.*

▸ *PORTABLE POWER TOOLS*—covered in brochure with complete

Consulting Engineers for Baylor University Medical Center: Zumwalt & Vinther, Dallas. Architects: Thomas, Jameson & Merrill, Dallas. Plumbing Contractors: Brown & Olds Plumbing & Heating, Dallas.



High Capacity **BRUNER** Equipment Supplies Soft Water for Baylor University Medical Center, Dallas, Texas

Soft water used in laundry and dietary facilities for Baylor Medical Center's three hospitals improves the appearance of uniforms and linen, makes dishes shine, cuts soap consumption by approximately 50%. Here, and across the U. S. leading engineers specify Bruner water softeners, America's most complete line. Full information is available from Bruner Sales Offices in all major cities.

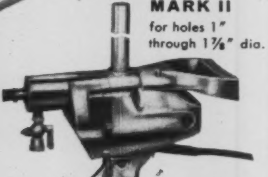
BRUNER
WATER SOFTENERS & FILTERS

BRUNER Corporation
4767 North 32nd Street, Milwaukee 9, Wisconsin
DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.

IT'S TIME FOR A CHANGE

NOW . . . drill masonry
Faster, Safer, Easier
At Lowest Cost
with Mobile
DIAMOND CORING MACHINES
and
"Thinline" Oriented Diamond Bits

MARK I
for holes to 1" diameter.


MARK II
for holes 1" through 1⅞" dia.

MARK III
for holes to 6½" diameter.

Drilling ammeter takes guesswork out of rack and gear feed.
Drills vertically and horizontally.

Write for details on the Mobile MARK Series Diamond Coring Machines, "Thinline" Oriented Diamond Bits and accessories . . .

MOBILE DRILLING, INC.
Dept. 14
960 N. Pennsylvania St.
Indianapolis, Indiana

RECENT TRADE LITERATURE

Continued

data and specifications, illustrations on hammer and drills, masonry breakers and others. *Syntron Co., 161 Lexington Ave., Homer City, Pa.*

▶ *POSITIVE DISPLACEMENT PUMP*—which employs corkscrew-like rotor operating at 1760 rpm within contoured stator detailed in bulletin "B-142;" units are available in four series, with 500 to 3300 gallons per hr capacities, lifts to 1000 ft, pressures to 50 psi; for 4 in. and larger diameter wells. *Peerless Pump, Hydrodynamics Division, Food Machinery and Chemical Corp., 301 West Ave. 26, Los Angeles, Calif.*

▶ *POWER TRANSMISSION EQUIPMENT*—including V-belt drives, flexible couplings, screw conveyors, roller bearing pillow blocks, speed reducers, sprocket-and-chain assemblies, fluid drives, and others covered in general engineering catalog with comprehensive index. *Dodge Mfg. Corp., Mishawaka, Ind.*

▶ *PREFABRICATED COILS*—for heating and cooling flat and curved surfaces illustrated in bulletin "M-10" with selected types covered that are representative of designs available for individual requirements. *Dean Products, Inc., 616 Franklin Ave., Brooklyn 38, N. Y.*

▶ *PRESSURE REDUCING VALVES*—featured in bulletin titled "Eliminate Water Waste With Controlled Pressure," with description of operation of water reducing valves and information on proper sizing procedures; bulletin "553-A". *Leslie Co., 105 Delafield Ave., Lyndhurst, N.J.*

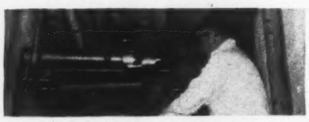
▶ *PRESSURE AND TEMPERATURE RECORDERS*—spiral bourdon tube and bellows type pressure elements, mercury, vapor pressure, gas pressure and organic liquid tem-

IT'S TIME FOR A CHANGE

NOW . . . drill
ONE-INCH
every
30 seconds
through
STEEL-REINFORCED CONCRETE
with the Mobile
MARK IV
hydraulic-powered
DIAMOND CORING MACHINE
and Mobile "Thinline" Oriented Diamond Bits

FASTER
SAFER
QUIETER
DUST-FREE
PORTABLE
EASIER TO OPERATE
MORE ECONOMICAL

DRILLS VERTICALLY – DRILLS HORIZONTALLY



Write for bulletin on MARK IV and complete Mobile line of Diamond Masonry Coring Machines and "Thinline" Oriented Diamond Bits . . .

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PUTS the STAMP of APPROVAL and GUARANTEE of the MOST PERFECTLY DESIGNED PRODUCTS

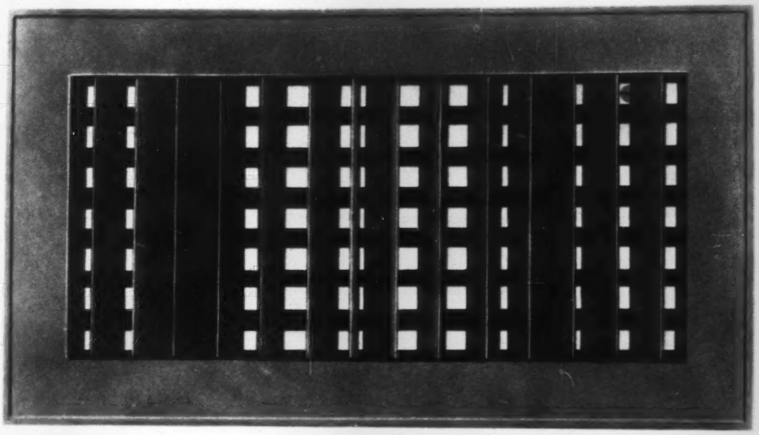
on their Commercial and Residential Lines of the LATEST AIR CONDITIONING REGISTERS and GRILLES

Smooth Seamless Corners

SCREW-DRIVER Operation

Guarantees Air Volume

Control Against Molestation



More Free AREA

LOWEST Sound Rating

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OTHER STLYE NUMBERS Furnished to give any Designed Performance

No. 190 U.S. Series MULTIFLEX REGISTER

SCREW-DRIVER OPERATED. VERTICAL and Horizontal STREAM-LINED INDIVIDUALLY ADJUSTED GRILLE-BARS Control The Volume and Direct the AIR-FLOW with ALMOST HUMAN INTELLIGENCE. BRING Your Files up to date—Specify and Order U.S. The WORLD'S FINEST—USED over the ENTIRE GLOBE. GET OUR LATEST and Most UNDERSTANDABLE

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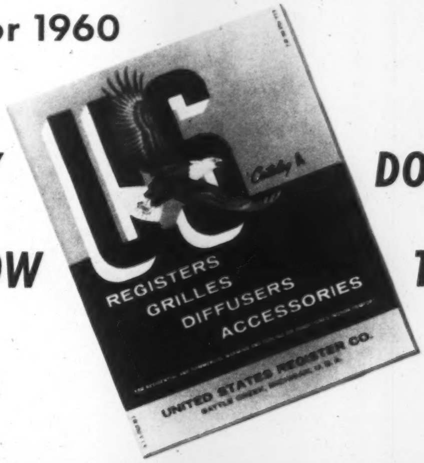
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MUELLER CLIMATROL
Gas Suspended Unit Heater

- Complete size range from 25,000 to 225,000 BTU/hr.
- Efficient, safe, all-welded, tubular-design heat exchanger
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- AGA approved for Natural, Mixed, Mfd., Propane gas
- Shipped assembled, pre-wired, and test fired.

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DIVISION OF WORTHINGTON

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THE COMPLETE LINE FOR INDOOR CLIMATE CONTROL

MC-44

CUTTING POWER!

Doors Through 18-inch Walls

How do you cut doors and windows through *18-inch reinforced concrete walls* without ruinous delays? A general contractor got the job done and out of the way with Longyear diamond drilling equipment. *Workmen cut around the openings with 6-inch diamond bits,* and carefully lifted out the giant slabs of concrete. The whole job was done in a few days at low cost and the entire project was kept on schedule. Your Longyear dealer can show you *other* diamond drilling applications that are cutting construction costs, and tell you about the new industrial diamond drills.

Adv-169

Longyear

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Minneapolis 2, Minnesota
Phone: FEderal 9-7631

Please send complete information on Longyear Diamond Bits and Industrial Drills. Also the name of my nearest Longyear dealer.

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FIRM ____________________
ADDRESS ____________________
TOWN __________ STATE __________

RECENT TRADE LITERATURE
Continued

perature elements, detailed in catalog "800" with illustrations of mechanical construction features, listing of material and performance characteristics, optional construction features, case dimensions, and details of pressure and temperature connections. *U. S. Gauge Division of American Machine and Metals, Inc., Sellersville, Pa.*

▶ *PUMPS*—centrifugal type, single and multiple stage, flexible and close coupled, horizontal and vertical, described in condensed bulletin with typical applications, capacity and head range for each type; line covers 1 to 9000 gpm units, discharge heads to 600 ft. *Aurora Pump Division, The New York Air Brake Co., Aurora, Ill.*

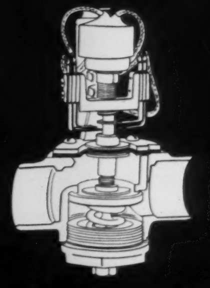
▶ *RADIATION DETECTORS*—of three types, all transistorized and battery operated described in bulletin; types are shirt pocket alarm, survey meter, and Beta-Gama survey meter. *Gelman Instrument Co., 106 N. Main St., Chelsea, Mich.*

▶ *SLIDING GATE REGULATORS*—for pressure control of steam, water, air, oil, gas, and corrosive chemicals; of stainless steel, in ½ to 2 in. body sizes, for pressures to 300 psi and temperature to 600 F; bulletin "JNP-4" describes features, shows cutaway drawings, gives sizing charts, flow curve, sample specification and complete engineering information. *OPW-Jordan, 6013 Wiehe Rd., Cincinnati 13, O.*

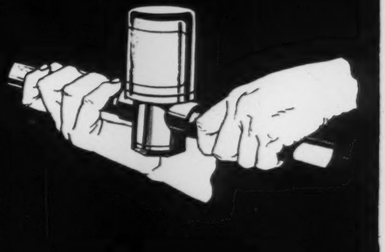
▶ *SOLENOID VALVES*—bulletin "S-2" details series for pressures from 0 to 150 psi, temperatures from −350 to 450 F, in bronze or stainless steel, ¼ to 1 in. pipe sizes. *Atkomatic Valve Co., 545 W. Abbott St., Indianapolis, Ind.*

▶ *STARTERS*—for central air conditioning applications in full voltage, reduced-voltage, auto-transformer,

Taco-Zone Va
PAT. PEND
MFG DATE
MOD NO
WATT.
PIPE SIZE
TO OPEN MANUALLY
COUNTERCLOCKWISE UNTIL
ABOVE OPERATION TO CLOSE
TACO HEATERS INCORPORATED
TACO
1



SIMPLE DESIGN



SIMPLE INSTALLATION

TOTAL COMFORT

New zone valve matched to modern comfort...

Easy to install, foolproof in operation, the economical new TACO-Zone provides the positive, reliable control that today's water heating and cooling systems demand.

Small and compact, the TACO-Zone closes tightly; mounts in any position. Just open manually before sweating . . . no need to remove head . . . wire only three terminals! No motors, gears, cams or pinions to cause trouble, wear or noise. Operates at a low, safe 24 volts. Power element crushes foreign particles which often foul ordinary valves, and is easily replaced without draining the system.

For your next heating or cooling installation, "build in" total comfort and troublefree operation with TACO-Zones. Be sure you have specifications on other TACO Products . . . the *complete* line that's "efficiency engineered" to cover the field. Write TACO HEATERS, INCORPORATED, 1160 Cranston Street, Cranston 9, Rhode Island.

TACO

SERVING THE HYDRONIC INDUSTRY SINCE 1920

down went heating costs by 35%

with Dravo *Counterflo* Heaters

Learn how one company switched to Dravo *Counterflo* warm air space heaters and reduced their heating bill by more than $6,000 per year. Plant is warmer, too, and 3,400 square feet of valuable space were made available for manufacturing. Use the coupon for full details.

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Pittsburgh 25, Pa.

Send me free copy of 12-page report on warm air space heating and the facts on the company mentioned above.

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Company __________
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City __________
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DRAVO CORPORATION

RECENT TRADE LITERATURE

Continued

and wye-delta types for 208 to 4900 v described in bulletin "8630" with electrical characteristics. *Square D Co., EC&M Division, 4500 Lee Rd., Cleveland 28, O.*

▶ *STEAM TRAP*—primer presents general discussion of condensate drainage and steam trap function, types of traps, capacities, accessories, maintenance; with special attention to line of thermostatic traps listing advantages claimed, questions and answers on operation. *Barnes & Jones, Inc., 34 Crafts St., Newtonville 60, Mass.*

▶ *STEPPING MOTOR*—or indexing device for operating valves, indicators, described in illustrated brochure "G-360-1" which gives information on unidirectional and bidirectional models, torque chart, description of internal mechanism, and environmental specifications. *Ledex, Inc., Dayton, O.*

▶ *TEMPERATURE CONTROLS*—for variety of industrial applications described in bulletin "108" which explains operation, circuitry, and safety features of three types of thermocouple actuated controls: proportioning model, manual reset, and automatic on-off type; with prices and ordering information. *Assembly Products, Inc., Chesterland, O.*

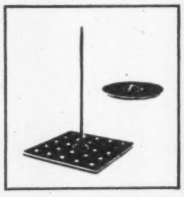
▶ *TEMPERATURE DETECTOR*—resistance type for −400 to 1200 F range, minimum span of 50 F detailed in specification "E51-5" with technical information, quotation-ordering data. *Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, O.*

▶ *THERMOCOUPLE ASSEMBLIES*—catalog "G100-1" describes over 100 complete assemblies including straight, angle, high speed, spring-loaded, and various special use types, with prices, specifications,

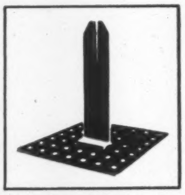
INSULATION INSTALLED FAST

WITH MIRACLE SURFACE ANCHORS

Use Miracle Surface Anchors, bonded with Miracle Anchor Adhesives, to provide firm support for block, board, or blanket type insulation. Eliminates drilling and welding. You save man hours, cut costs way down.



Use Spindle Anchors for bonding fibrous glass batts, mineral wool to ducts, walls, ceilings. Lock washer holds insulation firmly in place.



Use Pronged Anchors for bonding block insulation such as cellular glass. Pronged Anchors are set between rows of blocks and then prongs are bent over.

FREE

Valuable, informative engineers and architects bulletins giving details and complete specification data. Yours on request.

MIRACLE SURFACE ANCHORS
are manufactured by
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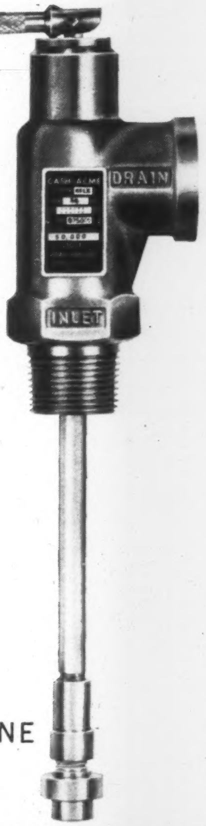
MIRACLE ADHESIVES CORP.
250 Pettit Avenue
Bellmore, Long Island, New York

TYPE

NFLX

SERIES

automatic reseating temperature and pressure relief valve



TOTALLY NEW.......

SETTING NEW STANDARDS OF SAFETY IN RESIDENTIAL WATER HEATER PROTECTION

Here's a relief valve engineered with a fresh outlook on hot water heater protection. The NFLX upgrades relief valve performance . . . raises safety margins in heater protection to approach instrument-like perfection.

Full ½" Seat Diameter: Assuring instant full relieving capacity.

Larger Flow-Ways: Precision cast valve body has larger flow-ways for maximum performance despite possible liming and scale accumulation.

Body Seat Elevated Above Drain Outlet: Prevents accumulation of solids around seating surface.

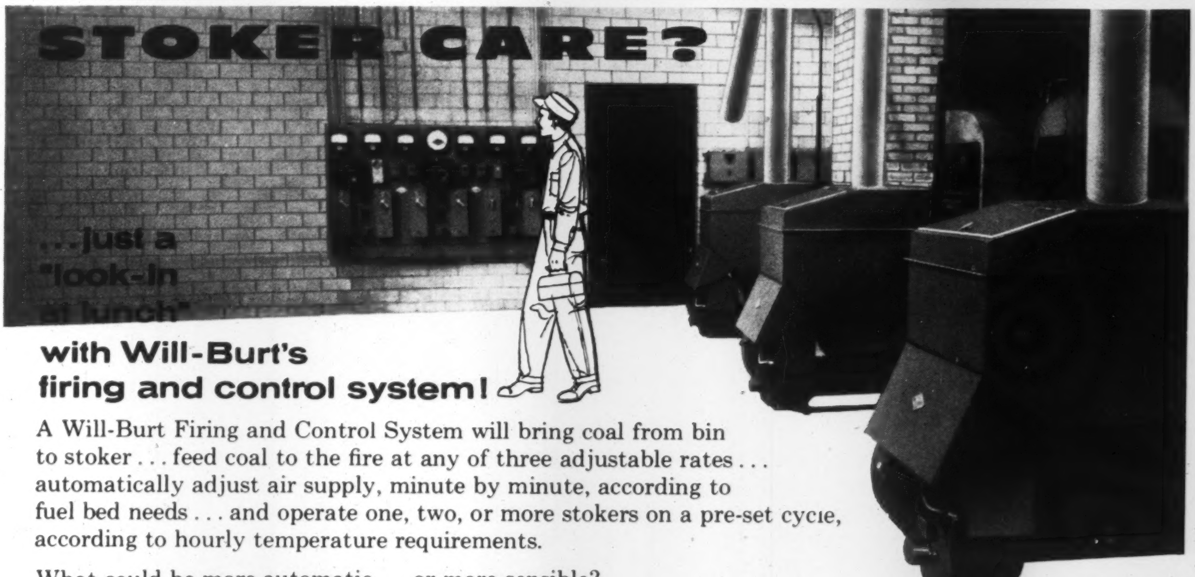
Newly Designed, More Powerful Thermostatic Element: Provides 35% more "push" for quicker more positive temperature relief. Solid-filled element has no liquids to leak . . . remains accurately sensitive for the life of the valve.

The NFLX fully meets all standards of FHA, AGA, requirements. Provides more than adequate protection as specified by ASA-1958 and FHA MPS-300.

Another quality-first product in
INDUSTRY'S WIDE, WIDE LINE
OF AUTOMATIC VALVES

A. W. CASH VALVE
MFG. CORP.
666 E. Wabash Ave.
Decatur, Illinois

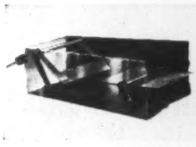
CASH
AUTOMATIC VALVES
ACME



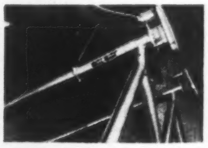
with Will-Burt's firing and control system!

A Will-Burt Firing and Control System will bring coal from bin to stoker . . . feed coal to the fire at any of three adjustable rates . . . automatically adjust air supply, minute by minute, according to fuel bed needs . . . and operate one, two, or more stokers on a pre-set cycle, according to hourly temperature requirements.

What could be more automatic . . . or more sensible?



W-B Automatic self-adjusting Air Control . . . part of every W-B Stoker.



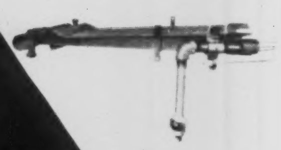
W-B Coal Conveyor . . . power-reversing to clear obstructions . . . operates at any angle.

WILL-BURT

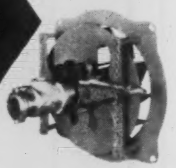
Take our word for it, it's economical. Write direct – or ask your Will-Burt Stoker Specialist for bulletins and help on selection and installation.

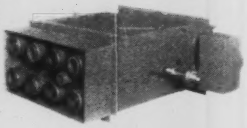
WILL-BURT STOKERS • Orrville, Ohio

Webster
BUILDS BOTH



GAS and/or OIL BURNERS





and CONTROL CENTERS

Webster can take full responsibility for a complete system.

WEBSTER ENGINEERING
Division of Midland-Ross Corp.
TULSA 9, OKLAHOMA
M-R
MIDLAND-ROSS CORP.

RECENT TRADE LITERATURE

Continued

illustrations, dimensions and ordering information. *Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa.*

▶ *TIME SWITCH*—7-day period for control of heating, air conditionig, and ventilation units featured in bulletin "72" with section on selection, detailed drawings, enclosures, mounting brackets, capacity and reserve power all included. *Tork Time Controls, Inc., Mount Vernon, N. Y.*

▶ *UNIT HEATERS*—horizontal and down blow models detailed in catalog "956-R4-1-60" with general discussion of corrosion, air distribution charts, heating capacities, conversion tables, illustration of construction. *D. J. Murray Mfg. Co., Wausau, Wis.*

▶ *VALVES*—and other industrial products featured in two new catalogs: "160" describes general purpose valves, flare fittings, shut-off valves, drain cocks, tube working tools, brass pipe fittings and others; "R460" lists flare tube fittings, hermetic port valves, charging lines, driers, strainers, capillary tubing, tube piercing valve, and others. *Madden Brass Products Co., P. O. Box 444, Aurora, Ill.*

▶ *WATER HAMMER ARRESTOR*—manual "60-2" describes stainless steel unit which features "nesting" bellows, dry air charge, compression ratio boosters, also describes sizing method for selection of units for multiple branch installations. *Zurn Industries, Inc., Erie, Pa.*

▶ *WELDING FILLER RODS*—of 22 types for use in welding nine different metals are listed with other brands in comparison chart "N-126"; chart also lists and illustrates 10 fluxes, provides guide for ordering. *National Cylinder Gas Division, Chemetron Corp., 840 N. Michigan Ave., Chicago 11, Ill.*

Send for This Useful Reprint Volume

"Correct Practice in Industrial Piping"

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— All-New Third Edition —
196 Pages — 8½" x 11" — $1.50

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This practical book is made up of outstanding papers and data on industrial piping selected from past issues of "Heating, Piping & Air Conditioning." It is a most comprehensive collection of case studies, showing how various difficult piping problems encountered in different industrial plants were successfully worked out by piping experts.

Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in pulp and paper and steel mills, in automobile plants and breweries, in the food and chemical and textile industries, and in many other types of manufacturing plants are dealt with from many different angles.

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KEENEY Publishing Company
6 North Michigan Ave., Chicago 2, Ill.

WE HEAR THAT...

▶ *LENNOX INDUSTRIES INC.*, has begun an approximate 50,000 sq ft addition to its heating and air conditioning plant in Marshalltown, Ia., for completion in early 1961.

▶ *COLLINS MACHINERY CORP.* has begun production of its line of pipe threading and cutting machines in new facilities in Monterey Park, Calif.

▶ *DK MANUFACTURING CO.* has announced acquisition of *DUNBAR-KAPPLE, INC.*, Batavia, Ill., to be known as Dunbar-Kapple Division.

▶ A fleet of three business aircraft was recently acquired by *PANGBORN CORP.*, for the principal objective of providing additional customer service.

▶ Frank Myers has retired after 38 years as district manager of the valve department of *OHIO BRASS CO.'s* New York and Eastern territory.

▶ *CARRIER CORP.* has announced a new multiple-choice financing plan for purchasers of industrial and commercial equipment, which includes cash or installment purchase or leasing arrangements.

▶ *THE UNIVERSITY OF ROCHESTER COLLEGE OF ENGINEERING* has announced the formation of a new mechanical engineering advisory committee composed of leaders in the field from various parts of the country (see *Who's What*, page 266).

▶ *THATCHER FURNACE CO.* has honored William R. J. White, engineering staff, and Daniel J. Buckley, Long Island district manager, for 50 and 45 years service to the firm, respectively.

▶ The Advertising Club of Washington, D. C. has presented its Award of Achievement to *THE DOW CHEMICAL CO.* for "scientific achievements and leadership in the chemical industry contributing to a greater and better America."

▶ *LEIGH INDUSTRIES INC.*, a subsidiary of *AIR CONTROL PRODUCTS, INC.*, has begun production and distribution of registers, grilles, and diffusers in its new plant in Asheville, N. C.

▶ Ground has been broken for Florida's first commercial air separation plant, to be built in Tampa by *AIR REDUCTION CO., INC.*

▶ *MINNEAPOLIS-HONEYWELL'S BROWN INSTRUMENT DIVISION* has expanded its facilities for the production of thermocouple and other pyrometer equipment through new quarters in Philadelphia and Los Angeles.

DOUBLE DUCT UNITS

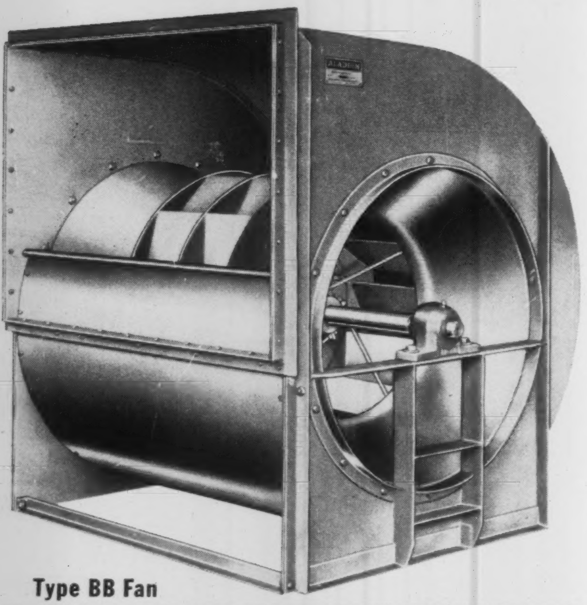
MULTIPLE ZONE UNITS

ARTICULATED AIR CONDITIONING UNITS

AIR CONDITIONING EQUIPMENT

A&R

AIR & REFRIGERATION CORPORATION
439 MADISON AVE. • NEW YORK 22, N. Y.
SALES REPRESENTATIVES IN PRINCIPAL CITIES



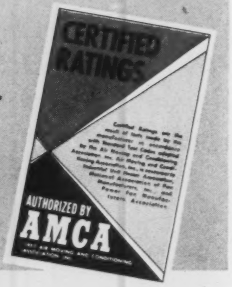
Type BB Fan

Aladdin

AIR HANDLING EQUIPMENT

For EFFICIENCY and QUIET OPERATION...

CERTIFIED PERFORMANCE



ALADDIN Type BB Fans are the first choice of many engineers for heating, ventilating and air conditioning jobs. Designed for low rotational speeds and high efficiency, these fans insure that stable performance from free delivery to shutoff that engineers have come to expect of this type of equipment.

In designing the BB Fan, Aladdin engineers have refused to short-cut quality, each fan is ruggedly built and is backed by thirty-five years of experience and manufacturing know-how.

Write for complete data

A1

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

WE HEAR THAT

Continued

▶ Dr. E. Sawicki and associates at the *ROBERT A. TAFT SANITARY ENGINEERING CENTER*, Cincinnati, O., are now engaged in analysis of air samples collected over nine major U. S. cities to determine the concentration of benzo-pyrene (BaP), a polynuclear hydrocarbon suspected as a cause of cancer.

▶ Construction of a new 140,000 sq ft *KEASBEY & MATTISON CO.* pipe plant has begun in Hillsboro, Texas.

▶ *BRIDGEPORT BRASS CO.* has begun emphasized marketing of welding and brazing rod and wire under its own trademark.

▶ *WOLVERINE TUBE*, a division of *CALUMET & HECLA, INC.*, has opened new mill depot and branch office facilities in Dallas, Texas.

▶ *RAYTHEON CO.'s* Commercial Apparatus and Systems division has moved to new office, engineering, and manufacturing quarters in Newton, Mass.

▶ *THE AMERICAN FORGED FITTING & FLANGE ASSOCIATION* has moved its offices to 333 N. Michigan Ave., Chicago, Ill.

▶ *JANITROL HEATING & AIR CONDITIONING*, a division of *MIDLAND-ROSS CORP.*, has announced a new plan under which users of commercial and industrial equipment can lease units for periods of from two to ten years.

▶ Ralph H. L. Becker has announced his retirement after 10 years as managing director of the *OIL HEAT INSTITUTE OF AMERICA*.

▶ *CARLOS HIDALGO, Professional Engineer*, has announced that he is now engaged in practice as a consulting engineer in the field of heating, piping, and air conditioning, with offices at 311 Longview, Waukegan, Ill.

▶ *FRAM AIRE CORP.*, a division of *FRAM CORP.*, has opened new production facilities for its line of heating and cooling filters in Henderson, N. C.

▶ *FRIEDMAN, ALSCHULER & SINCERE, Architects and Engineers*, have moved to new offices at 130 N. Franklin St., Chicago 6, Ill.

WE HEAR THAT

Continued

▶ Henry Sleik, past director, vice president, senior application engineer, and supervisor of foreign operations has retired from active participation in *CONNOR ENGINEERING CORP.*, but will continue to serve as a technical assistant.

▶ *CRANE CO.* announced it has purchased the fixed assets and inventory of the *GENERAL AIR CONDITIONING CORP.* of Los Angeles.

▶ *INGERSOLL PRODUCTS DIV., BORG-WARNER CORP.*, has acquired the *ELGIN METALFORMERS CORP.*, Elgin, Ill., manufacturer of metal modular-type enclosures for electronics and other industries.

▶ *AMERICAN ZINC INSTITUTE, INC.*, has occupied new quarters at 292 Madison Ave., New York 17, N. Y.

▶ *CHEMETRON CORP.* has completed arrangements to acquire *CLYDE TUBE FORGINGS, LTD.*, Glasgow manufacturer of welding fittings.

▶ *C. H. WHEELER MFG. CO.* and *GRISCOM-RUSSELL CO.* have combined business operations.

▶ *PORTER & CIE, S. A.*, international subsidiary of *H. K. PORTER CO., INC.*, has acquired substantially all the outstanding shares of *ALCACE S. A. FABRICA de APARELHOS ELECTRICAS de BAIXA e ALTA TENSAO*, Sao Paulo, Brazil manufacturer of electrical equipment.

▶ *WALWORTH CO.* has reorganized its sales department to emphasize valve marketing under the direction of Harold Brown, vice president, sales.

▶ *CONTINENTAL CONTROLS CO.* has been organized in Nashua, N. H. for the manufacture of electrohydraulic controllers and to provide consulting service on special control problems.

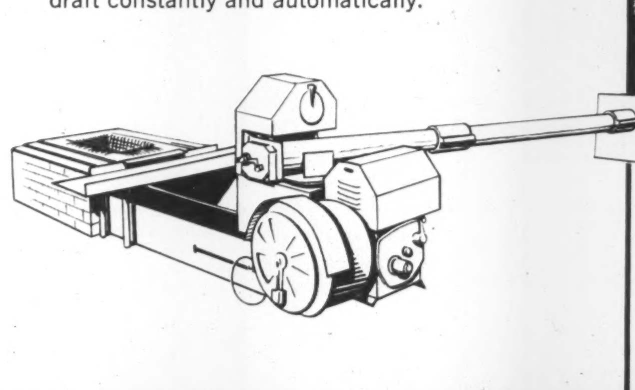
▶ *THE KAYDON ENGINEERING CORP.* has completed a new quality control laboratory equipped with precision gage setting and measuring facilities.

▶ *FLEXONICS CORP.*, a subsidiary of *CALUMET & HECLA, INC.*, has announced a new marketing approach to the sale of flexible metal hose to industry and will identify its distributors with the symbol "PMS" for Pipe Motion Specialists.

▶ *REPUBLIC-TRANSCON INDUSTRIES, INC.*, has announced completion of its internal corporate setup following merger of *REPUBLIC APPLIANCE CORP.* and *TRANS CONTINENTAL INDUSTRIES*. The company is now publicly owned.

MILWAUKEE ELKS CHOSE A MODERN STOKER*

* The modern Combustioneer CB Model Commercial Stoker, with a universal bin feed loader that conveys coal from nearly any angle and the unique sequence draft control to provide correct over-fire draft constantly and automatically.



- **Rugged steel construction for long-life service**
- **Heavy duty transmission with no chains, no sprockets, no bearings to lubricate**
- **Patented automatic air respirator for correct fuel and air balance**
- **Burns coal, for greatest heating economy of any fuel**

BITUMINOUS COAL EQUIPMENT, INC.
CARPENTERSVILLE, ILLINOIS

WHO'S WHAT . . .

(New personnel, promotions)

▶ *FAIRBANKS, MORSE & CO.*—H. E. Hanson, vice president and general manager of Beloit Division.

▶ *GRAVER WATER CONDITIONING CO.*—Joseph H. Duff, technical manager; Martin Wank, sales promotion manager.

▶ *GENERAL ELECTRIC CO.*—Raymond H. Rogers, marketing manager, specialty transformer department.

▶ *AIR REDUCTION CO., INC.*—new members, board of directors: John T. Dorrance, Jr., assistant to the president, Campbell Soup Co.; Dr. Richard G. Folsom, president, Rensselaer Polytechnic Institute; August J. Thoma, vice president of Air Reduction Co., Inc.

▶ *CRANE CO.*—new directors: Wesley A. Songer, president, Crane Co.; Robert Heller, Robert Heller and Associates, Inc.; Charles W. Veatch, retired vice president, The Mellon National Bank and Trust Co.; new vice president of finance: J. Curran Freeman; new marketing services manager, plumbing-heating-air conditioning group: Robert V. Main.

▶ *CHEMETRON CORP.*—Charles J. Haines, chairman and chief executive officer; James W. Dunham, president and finance chairman.

▶ *BELL & GOSSET CO.*—L. J. Smith, vice president in charge of research; John P. Marshall, comptroller.

▶ *WARREN WEBSTER & CO., INC.*—Charles F. Donahue, controller.

▶ *DRAVO CORP.*—Louis A. Mertz, senior vice president; Edward T. Fitch, vice president, financial; Ival L. Hillman, treasurer; Joseph V. Newman, controller.

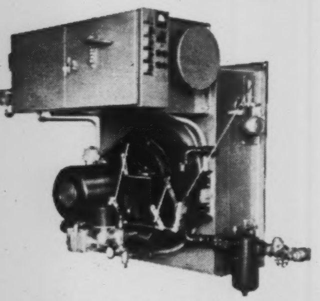
▶ *YORK DIVISION, BORG-WARNER CORP.*—R. F. Kelly, manager of distribution.

▶ *AURORA PUMP DIV., THE NEW YORK AIR BRAKE CO.*—Russel K. Annis, manager of engineering.

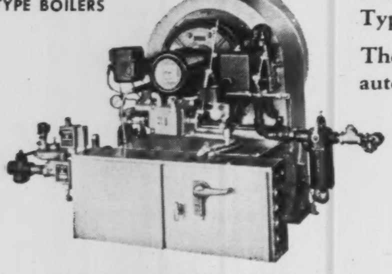
▶ *HI-PRESS AIR CONDITIONING OF AMERICA, INC.*—Vice Admiral Roscoe H. Hillenkoetter, USN (Ret.), to board of directors.

For maximum Heating Economy... **JOHNSON FORCED DRAFT** *Package Unit* **BURNERS**

Get Smooth . . . Quiet . . . Exceptionally Efficient Combustion regardless of Stack Conditions and Firebox Pressures!



FOR FIREBOX TYPE BOILERS



FOR SCOTCH TYPE BOILERS

These compact burners are available for firing on Oil only . . . Gas only . . . and for Combination Oil or Gas firing. With either fuel, they deliver low-cost heating with a minimum of servicing and supervision. There's a size for every heavy-duty heating need, from 28 HP to 560 HP.

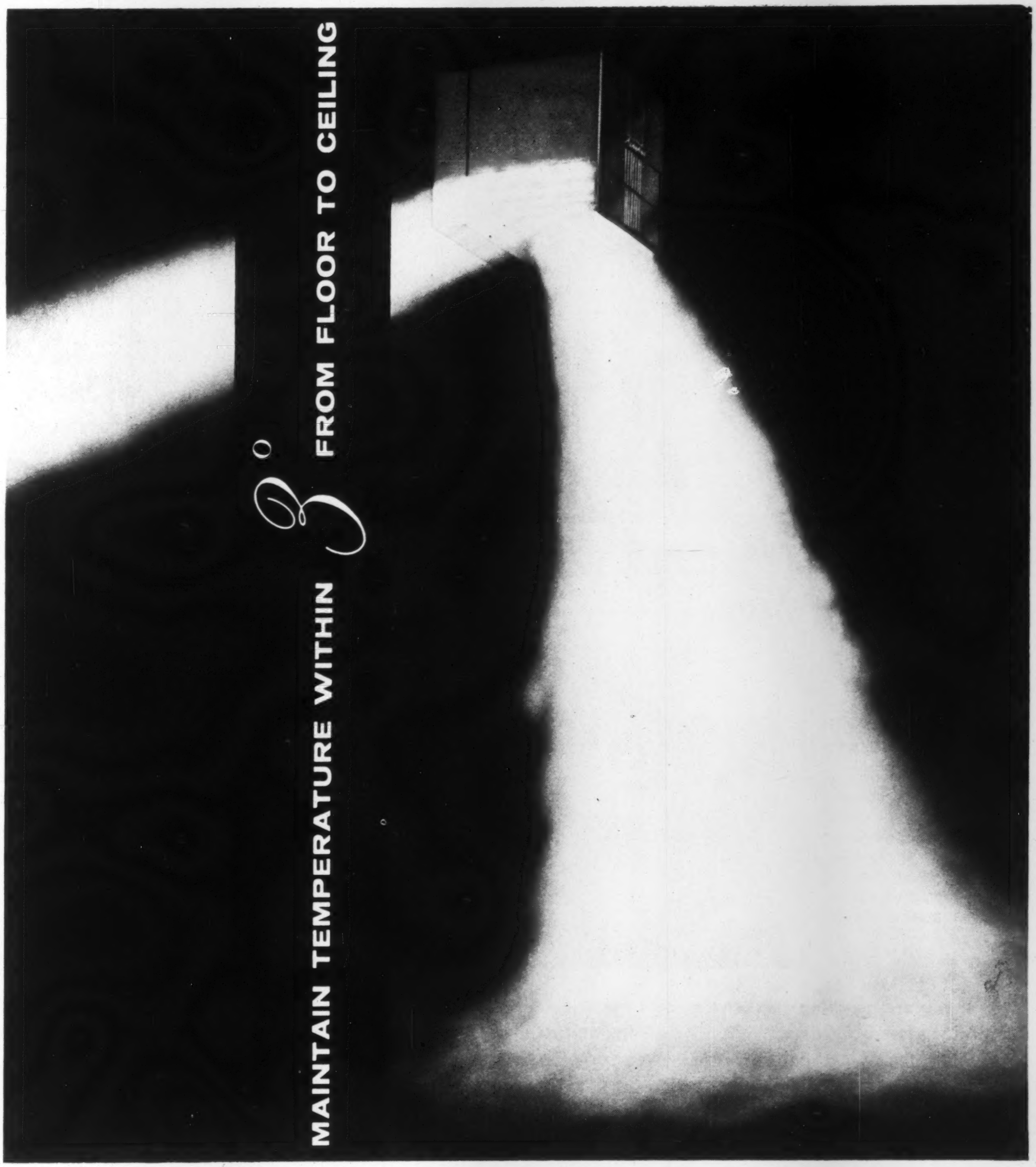
These "package-unit" burners come to you completely assembled, wired and tested . . . ready for quick, inexpensive installation. Models are available for use with either Scotch Type or Firebox Type boilers.

They are powered by the world famous Johnson 53 Burners which automatically maintain a fixed air-fuel-ratio regardless of variations in oil viscosity . . . thus insuring easier, faster "cold starts" when the oil in tank and fuel lines is cold and hard to pump. If you seek truly fine performance and low operating costs on your big heating jobs, by all means check up on these Johnson Forced Draft Burners.

Johnson Burners

S. T. JOHNSON CO.
940 Arlington Ave., Oakland 8, Calif.
Church Road, Bridgeport, Pennsylvania

Builders of fine Oil Burner Equipment since 1903



UNIT HEATERS MAINTAIN TEMPERATURE WITHIN 3° FROM FLOOR TO CEILING

ARKLA-Humphrey

Arkla-Humphrey Multi-Directional unit heaters are accepting congratulations now. At long last, industry's toughest heating problems have been solved by the Multi-Directional!

Tests show a 15.38% fuel saving with only a 3° temperature differential from floor to 18′ ceiling! Smoke photo above shows you why. The Multi-Directional is the first and only unit heater to discharge heat straight down, out in front, or from either side, or any combination of these three! Pulling the heat from the ceiling with top mounted fans eliminate overheated ceilings, too.

Write for complete information.

MANUFACTURED BY ARKLA AIR CONDITIONING CORPORATION
GENERAL OFFICES SHANNON BUILDING LITTLE ROCK, ARKANSAS

POLYFUSION*

is one more reason

Vulcathene® DRAINLINES

are rugged and unbreakable!

Putting VULCATHENE Pipe and Fitting on Polyfusion Tool.

Joining VULCATHENE Pipe and Fitting by Polyfusion . . . without glue, cement or solvents.

DOUBLE-STRENGTH AT EVERY JOINT

Cutaway of VULCATHENE Pipe and Fitting showing complete fusion of material. *Note that it is impossible to see point of joining.*

If you are handling corrosive or acid materials, VULCATHENE, of *finest grade,* virgin polyethylene, will solve your drainline problems. VULCATHENE is light, easy-to-handle . . . assembles fast, with the polyfusion technique forming permanent, *leak-proof joints.*

Nothing adheres to VULCATHENE. Even after years of service, the inner walls of VULCATHENE are still smooth, assuring fast flow of waste and sludge.

Today, many leading industries are proving VULCATHENE the most practical and economical plumbing yet devised for laboratory and industrial drains.

*For literature or technical assistance—**Write** Dept. F-2*

*PATENTED

American Vulcathene

P. O. BOX 365 ROCHESTER 2, NEW YORK

DIVISION OF THE NALGE CO. INC.

WHO'S WHAT

Continued

▶ *BOHN ALUMINUM & BRASS CORP.*—P. G. Kayser, manager, B. W. Reid, sales manager, and Frank Oreskovick, senior application engineer, heating and cooling coil department; Raymond C. McCullough, sales manager, extrusions and new products.

▶ *COUSE AND BOLTEN CO.—HYDRAULICS, INC.*—J. B. Daner, president and treasurer; P. F. Nelson, vice president and secretary.

▶ *IRON FIREMAN MFG. CO.*—J. H. Jordan, vice president and manager, heating and cooling division.

▶ *BASTIAN-MORLEY CO.*—John V. Youngblood, vice president, marketing, for parent company and H. C. Little Burner Co. subsidiary.

▶ *CLIMATE EQUIPMENT, INC.*—Richard L. McCusker, vice president.

▶ *CLAYTON MARK & CO.*—Clarence Mark, Jr., executive vice president.

▶ *NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION*—new chairman for public relations committee: R. H. Smith, secretary, The Reliance Electric & Engineering Co.

▶ *WAGNER ELECTRIC CORP.*—Carl E. Widell, vice president in charge of marketing.

▶ *VAPOR HEATING CORP.*—E. B. Moore, publicity director.

▶ *UNIVERSITY OF ROCHESTER, COLLEGE OF ENGINEERING*—members of newly formed Mechanical Engineer Advisory Committee: Leo H. East, executive vice president, Rochester Gas & Electric Corp.; Dr. John C. Fisher, General Electric Co.; Dr. John C. Evvard, assistant director, Lewis Research Center, NASA; Dr. Stewart Way, Westinghouse Electric Corp.; Dr. Arthur R. Kantrowitz, director, Avco-Everett Research Laboratory.

▶ *REVERE COPPER AND BRASS INC.*—John W. Eason, vice president.

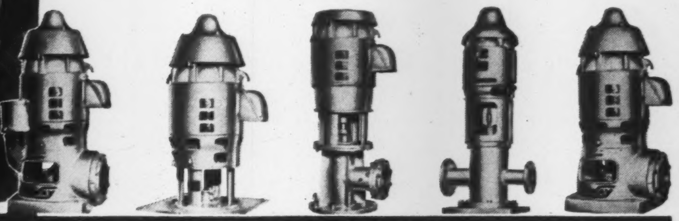
▶ *INGERSOLL-RAND CO.*—Joseph A. Wiendl, general manager of sales.

VERTICAL TURBINE PUMPS

FLOWAY
formerly SMITHway

What's Your Problem?

If it's industrial pumping, FloWay has the answers, along with innumerable variations for your specific needs. For cooling, process pumping, booster service, transfer or pipe line pumping—or practically every other need—FloWay solves the problems. Send for Bulletin #14.



FLOWAY Pumps

MANUFACTURED BY
FIESE & FIRSTENBERGER MFG., Inc.
2494 Railroad Ave. Fresno, Calif.

Contact your FloWay distributor

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Pacific Pumping Company

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Denver, Colorado
Harry J. Glass & Associates

Oakland Park, Florida
Peninsular Armature Works

Metarie, Louisiana
A. G. Kirkwood Co.

Baltimore, Maryland
R. Thum & Company

Buffalo, New York
Ralph Simmons & Company

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Frank A. Kristal

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The Kase Company

Portland, Oregon
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Ardmore, Pennsylvania
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Weinman Pump & Supply Co.

Dallas, Texas
Livingston Machinery Co.

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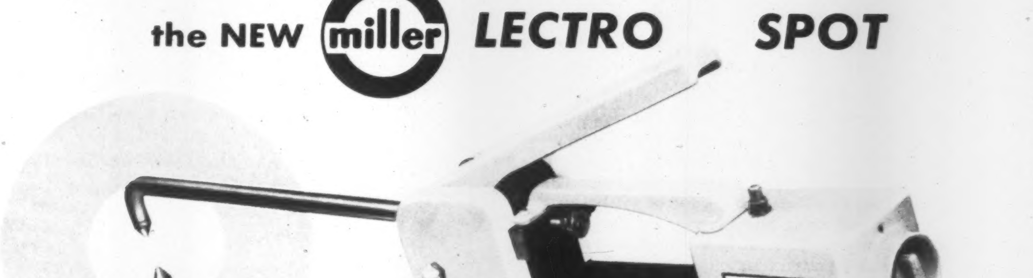
Pump & Power Engineering Co.

Seattle, Washington
Pacific Pumping Company

Hottest "Spot" in the Shop

the NEW miller LECTRO SPOT



Simply depress lever and tongs grip metal at pre-determined pressure, switch is turned on and weld sequence timer is actuated for precise period set on control dial. Thus, every weld is identical until timer adjustment is changed. Pilot light indicates when welder is connected.

This advanced design plus light weight and wide selection of tongs make the new Miller Lectro Spot the finest welder of its type.

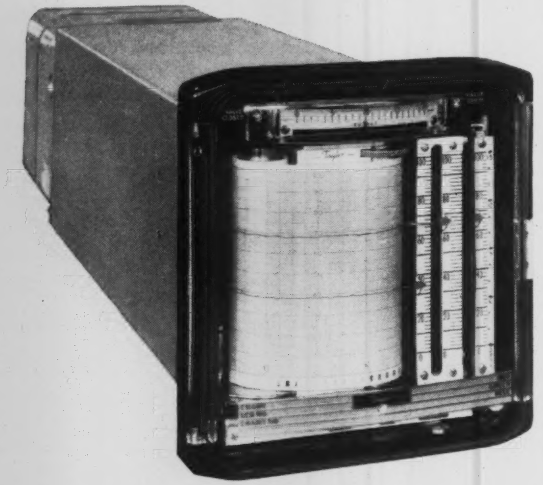
Available in three styles: 115v or 230v, 1.5 KVA models for work to 1/8" thickness, both weigh 29 lbs.; 230v, 2.5 KVA model for mild steel to 5/32", weighs 37 lbs.

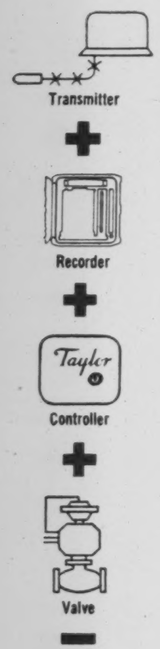
Complete specifications with tong and tip availabilities will be sent promptly upon request.

miller ELECTRIC MANUFACTURING COMPANY, INC. • Appleton, Wisconsin

Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

EXCEPTIONAL CONVENIENCE





MODERN PROCESS CONTROL

No other recorder, regardless of size, puts so many features in so little panel space

The Taylor TRANSCOPE® Recorder (90J) is now generally recognized as the most modern, most convenient and most accurate instrument for recording process variables at a central point.

Servo-operated Pens assure unprecedented accuracy of records.

Front of Panel Control Settings let you make adjustments easier, quicker and better . . . *from the front of panel* . . . while recording!

Stays on Automatic Control while the plug-in recorder slide is removed for inspection, yet providing continuous fully automatic control.

Complete Indicating Control Station while recorder is removed. Horizontal gage at top of recorder will show either process variable or air output to valve, as desired.

Recieves Three Variables to be recorded or indicated; has a Set Point Transmitter; Process Alarms with Memory Pointers; an Automatic-to-Mannual switching lever; a cascade or Process-output Indicator, and many other features . . . all in a compact case.

See your Taylor Field Engineer, or write for **Catalog 98286.** Taylor Instrument Companies, Rochester 1, N. Y., or Toronto, Ontario.

Taylor Instruments
MEAN ACCURACY FIRST

WHO'S WHAT

Continued

▶ *ROBERTS-GORDON APPLIANCE CORP.*—Henry K. Straw, vice president in charge of sales.

▶ *A. O. SMITH INTERNATIONAL S. A.*—James M. Leinenkugel, product manager, distributive products.

▶ *ALLIS-CHALMERS MFG. CO.*—J. D. Greensward, president, *Canadian Allis-Chalmers Ltd.;* Harold M. Schudt, director of manufacturing, *Allis Chalmers International.*

▶ *CONTINENTAL AIR FILTERS, INC.*—Sidney S. Emison, vice president.

▶ *GENERAL DYNAMICS CORP.*—Raymond B. Carey, Jr., general manager, Electro Dynamic Division.

▶ *COOLERATOR DIVISION, MCGRAW-EDISON CO.*—Robert F. Knudson, chief engineer of heating products.

▶ *GAS APPLIANCE MANUFACTURERS ASSOCIATION*—second vice president: J. F. Ray, vice president, *General Controls Co.*

▶ *AIRTEMP DIVISION, CHRYSLER CORP.*—Thomas W. Kirby, special markets manager; Guy R. Motto, product development engineer, heating products; John E. Fristoe, product planning analyst; Ralph Achelpohl, sales planning manager, commercial products.

▶ *AIR REDUCTION SALES CO.*—J. M. Crockett, vice president, gases.

▶ *UNITED STATES AIR CONDITIONING CORP.*—Reaver Culbertson, manager, coil products division.

▶ *L. J. KRAUSE CO., Minneapolis Manufacturers' Representatives*—Richard T. Demarest, associate.

▶ *BETTER HEATING-COOLING COUNCIL*—two new chairmen of commercial & industrial division task forces: William W. Wexler, manager of marketing, *Taco Heaters, Inc.,* for distribution and communications; Edward A. Grostas, divisional sales manager, *John J. Nesbitt, Inc.,* research and technical task force.

▶ *COMMERCIAL WATER HEATER CO.*—Lester C. Brandt, sales manager.

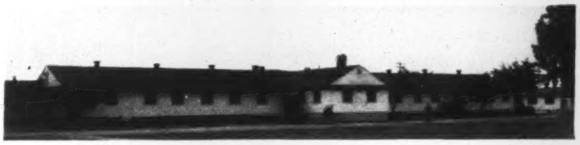
▶ *WOLVERINE TUBE DIV., CALUMET & HECLA, INC.*—R. C. Crowe, manager of product sales; L. A. Brewer, manager of Strubing sales.

▶ *PUNCH PRODUCTS CORP.*—Rocco L. Stefano, general manager; Ralph L. Weisbeck, sales manager.

▶ *HAUCK MFG. CO.*—Bernard G. McNally, sales manager, equipment division.

LARGE OR SMALL
LO-BLAST
POWER GAS BURNERS COST LESS TO OPERATE

Low cost installation and operation dictated Lo-BLAST selection in this modern school.

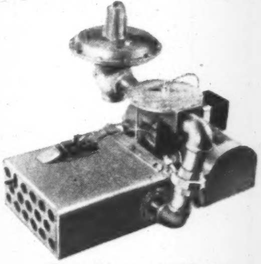

Sixteen Lo-BLAST Burners at this army camp burn 30,000 cu. ft./hr. of gas when all are operating.

In this development of 472 small homes, Lo-BLAST Economite Burners replaced oil burners originglly installed.

Lo-BLAST Burners cost on an average of 10% less to operate. They use an extremely quiet, low speed blower to provide perfectly controlled primary and secondary air from start to finish of each run. Operation is always independent of natural draft conditions—ideal for down draft boilers.

Cost less to install

Lo-BLAST Burners eliminate the need for high chimneys —inshot design and complete factory assembly reduce maintenance and installation costs. Each unit is factory tested on gas before shipment.


Capacities: 70,000 to 20,000,000 BTU/hr. input.

Write for literature

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

Fast, low-cost way to hold, seal duct insulation

Shuford's SHURTAPE® LF-65

Shuford's
SHURTAPE

Aluminum foil laminated to 40 lb. Kraft

You'll save time and your job will look neater when you install air conditioning and heating duct insulation with Shuford's SHURTAPE LF-65.

Used instead of staples, this easy-to-apply, pressure-sensitive tape cuts installation costs. It is inexpensive and the shining silver foil backing provides an inconspicuous seal with an excellent finished appearance.

SHURTAPE LF-65 stays put, too. It has high adhesion, excellent resistance to water and abrasion, and no measurable moisture vapor transfer rate. Use it for all types of holding and sealing applications where a shining silver tape is desired.

For free sample roll and complete information, write

Shuford SINCE 1880 **Mills, INC**
HICKORY, N. C.

CLOTHES LINES • TWINES
PRESSURE-SENSITIVE PAPER TAPES
SASH CORDS • WEATHER STRIPPING
COTTON & RAYON YARNS • EXTRUDED PLASTICS

World's Largest Manufacturer of Cotton Cordage

4779

WHO'S WHAT

Continued

▸ *CHAMBER OF COMMERCE OF THE UNITED STATES*—new president: Arthur H. Motley, president and publisher, *Parade* magazine.

▸ *JOSEPH T. RYERSON & SON, INC.*—Weaver E. Falberg to board of directors.

▸ *OLIN MATHIESON CHEMICAL CORP.*—Edward W. Ruhe, chief engineer, engineering and maintenance department, East Alton, Ill., Metals Division plant.

▸ *MARKET ELECTRIC PRODUCTS, INC.*—Frederick E. Warner, assistant sales manager in charge of built-in products.

▸ *ARMCO STEEL CORP.*—Lee F. Weitzenkorn, assistant to the vice president and general manager, Armco Division.

▸ *JOY MFG. CO.*—Alden T. Bloxham, manager of fan sales, Industrial Division.

▸ *A. W. CASH VALVE MFG. CO.*—William P. Klein, sales manager, wholesaler sales.

MEETINGS & CONVENTIONS

JUNE 13-15—*American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., annual meeting.* Vancouver, B.C., Canada. Information: American Society of Heating, Refrigerating and Air-Conditioning Engineers, 62 Worth St., New York 13, N.Y.

JUNE 14-19—*Electrical Precipitation Seminar.* The Pennsylvania State University. Information: Ralph E. Armington, Associate Chairman of Electrical Engineering, The Pennsylvania State University, University Park, Pa.

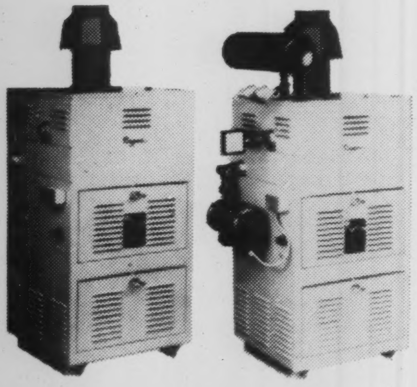
JUNE 20-24—*American Society for Engineering Education,* 68th *annual meeting.* Purdue University, Lafayette, Ind.

JUNE 26-*JULY* 1—*American Society for Testing Materials Annual Meeting.* Chalfonte-Haddon Hall, Atlantic City, N.J. Information: Fred F. Van Atta, Assistant Secretary, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Join the trend to **HYDRONICS** and **RAYPAK** the inseparable companions.

Raypak, America's most advanced gas-fired boiler line is moving ahead at a rapid pace — now features 9 sizes complete to 1,200,000 BTU/HR — more sizes coming.

Take your choice of the standard -T model or the packaged -TP model.



Raypak also manufactures swimming pool heaters, storage tanks and coils, heat exchangers and accessories.

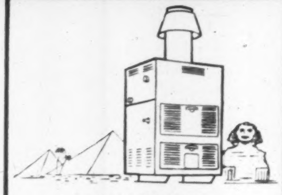
HEART OF THE HOUSE

BHC

MEMBER BETTER HEATING-COOLING COUNCIL

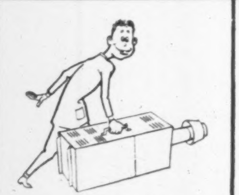
MODULATING GAS VALVE

Holds precise water temperatures — eliminates start and stop noise — saves fuel.



LIFETIME STAINLESS STEEL BURNER

Performance second to none.



LIGHT AND COMPACT

One man installation — saves space.

FINEST MATERIALS

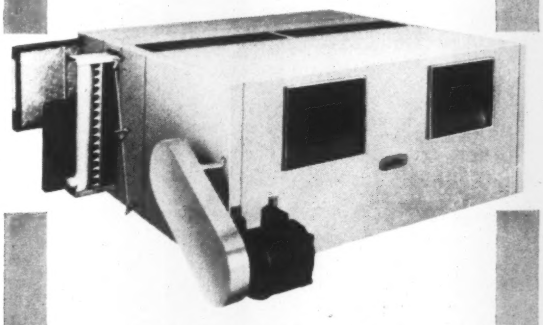
Solid 100% copper and bronze waterways — fastest controlled heat transfer on the market.

A few territories are still available to qualified manufacturers representatives.

Raypak COMPANY, INC.
® Engineers-Manufacturers 2231 CHICO AVENUE, EL MONTE, CALIFORNIA

USAIRCO

40 years experience in air handling units



Series 74 Unit Air Conditioner

RUGGED CONSTRUCTION

Built for Efficient Performance, Long Life and Trouble-Free Operation

WRITE FOR PRODUCT BULLETIN 74

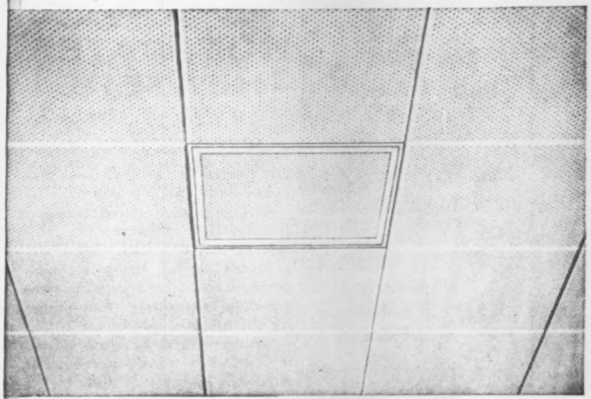
United States Air Conditioning Corporation
Delaware, Ohio

AGITAIR® Perfair

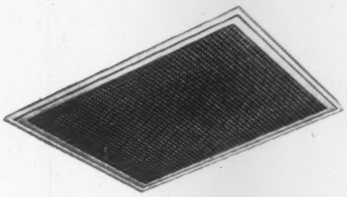
PERFORATED AIR OUTLETS

ADJUSTABLE — NON-ADJUSTABLE
SQUARE AND RECTANGULAR

the Ultimate in Application Versatility



AGITAIR PERFAIR diffusers provide the architect with a concealed air outlet that blends in perfectly with acoustical ceilings rather than calling attention to the mechanical installation. To complete the cycle of air distribution and conform with the architectural design, PERFAIR diffusers are also available as return or exhaust units in matching designs.



PERFAIR diffusers incorporate smartly designed mounting frames and exclusive AGITAIR removable diffuser cores which provide unmatched blow patterns in 1-2-3-4 way blows. The inner cores have an added feature... built-in direction controllers that provide deflection of the air stream from one or more sides individually in varying degrees from horizontal to downward delivery of air.

AGITAIR PERFAIR air diffusers are available for surface or tile mounting that will not only blend in with the ceiling design but will distribute the air noiselessly and draftlessly. AGITAIR PERFAIR is another genuine product designed for Better Air.

Send for complete Perfair Catalog

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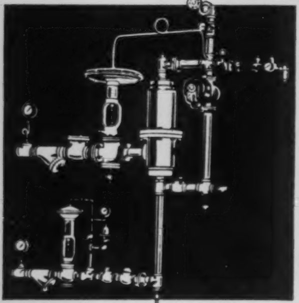
185 MADISON AVENUE • NEW YORK 16, N. Y.

BETTER PRODUCTS FOR
AIR DISTRIBUTION • AIR CLEANING • AIR EXHAUST

CUT HOT WATER COSTS



Pick STEAM INJECTION

HOT WATER HEATERS

8 sizes . . . 500 to 50,000 Gals. Per Hour

Hot water in a flash — produced only as it's needed!

Pick patented mixing chamber is completely automatic . . . direct contact of steam and water provides desired hot water temperature *instantaneously* . . . temperature accurately maintained by thermostatic controls.

Water volume adjustable from 5% to full rated capacity of heater. 20-second reaction to desired up-and-down changes in water temperature.

Write today to Dept. N

FREE BULLETIN
Shows how Pick Heaters are used in many industries.

Pick WATER HEATERS

PICK MFG. CO., West Bend, Wis.

DAVIDSON LOW PROFILE

HIGH CAPACITY
low velocity roof fan

PC PLEASING CONTOUR MODEL

New and streamlined . . . designed for today's modern flat roof structures . . . as much as 40% lower than conventional types . . . capacities up to 50,000 CFM . . . low velocity . . . vibration isolated . . . ratings conform to Standard Test Code.

DAVIDSON, first in the field, has been making a complete line of industrial and commercial roof fans since 1915. For information on the PC or other HYDUTY Davidson fans, write to

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MEETINGS & CONVENTIONS

Continued

SEPT. 7-9—Joint Automatic Control Conference, Massachusetts Institute of Technology, Cambridge, Mass.

SEPT. 14-17—Second Annual Southeastern Maintenance and Engineering Show. Sponsored by North Carolina chapters, American Institute of Plant Engineers, American Welding Society, and Maintenance Council of North Carolina Motor Carriers Assoc. State Fair Arena, Raleigh, N.C. Information: John Harden Associates, P.O. Box 3173, Greensboro, N.C.

SEPT. 26-29—American Welding Society Fall Meeting. Penn-Sheraton Hotel, Pittsburgh, Pa. Information: American Welding Society, 33 West 39th St., New York 18, N.Y.

SEPT. 26-30—Instrument Society of America, Fall Instrument-Automation Conference and Exhibit, and 15th *Annual meeting*. New York Coliseum. Information: W. F. Minnick, Jr., Director of Public Relations, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa.

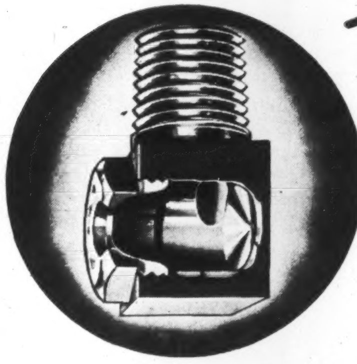
OCT. 12-15—Cast Bronze Bearing Institute and Non-Ferrous Founders' Society annual meetings. Grove Park Inn, Asheville, N.C. Information: Non-Ferrous Founders' Society, 1604 Chicago Ave., Evanston, Ill.

OCT. 17-21—48th Annual National Safety Congress. Industrial safety sessions, Conrad Hilton, Pick-Congress, Sheraton Towers, Morrison, and La Salle hotels, Chicago. Information: R. L. Forney, secretary, National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

NOV. 28-DEC. 2—24th National Exposition of Power and Mechanical Engineering. Under auspices of the American Society of Mechanical Engineers. New York Coliseum. Information: International Exposition Co., Inc., 480 Lexington Ave., New York 17, N.Y.

1961

FEB 13-16—American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., semiannual meeting and exposition, Chicago, Ill.



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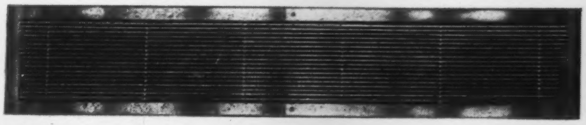

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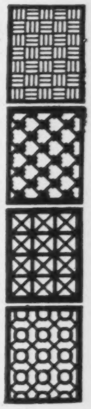

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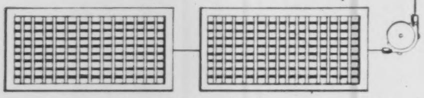

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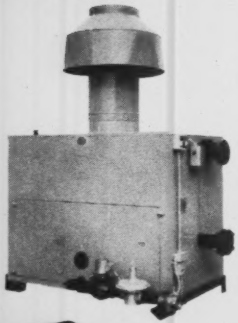

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Nozzle Guide—Third Edition. Compilation from 175 manufacturers. Wm. Steinen Mfg. Co., 43 Bruen St., Newark, N.J. $1.50

Plumbing, Heating, and Piping Estimators' Guide—208 pp., by Paul G. Davis. McGraw-Hill Book Information Service, 327 W. 41st St., New York 36, N.Y. $6.50

NEMA Standards Publications—Shunt Capacitors (CP 1-1960) 50 cents; Industrial Heating Units and Devices (HU 1-1960) 30 cents; Power Switching Equipment (SG 6-1960) $3.00

Code for Pressure Piping Interpretations—11 pp. The American Society of Mechanical Engineers, 29 West 39th St., New York 18, N.Y.

New Plastic Materials Through Government Research—98 pp. by James Kanegis. Office of Technical Services, U. S. Department of Commerce, Washington 25, D.C. $2.25

Basics of Fractional Horsepower Motors and Repair—168 pp. by Gerald Schweitzer, Fedders Corp. John F. Rider Publisher, Inc., 116 W. 14th St., New York, N.Y. $3.90

Engineering Thermodynamics—An introductory textbook by James B. Jones and George A. Hawkins. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. $8.50

Pipe Fitter's and Plumber's Vest Pocket Reference Book—by George K. Bachman. Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N.Y.

AWS Training Manual of Arc Welding—American Welding Society, 33 West 39th St., New York 18, N.Y. $3.00

Welding Handbook Section III—512 pp. Miscellaneous metal joining and cutting processes. American Welding Society, 33 West 39th St., New York 18, N.Y. $9.00

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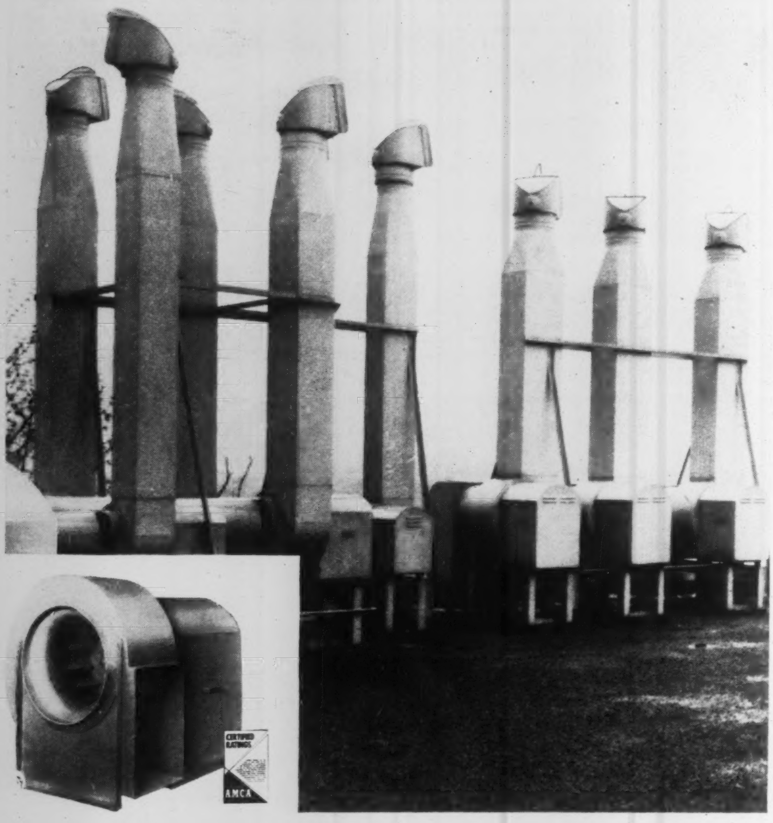

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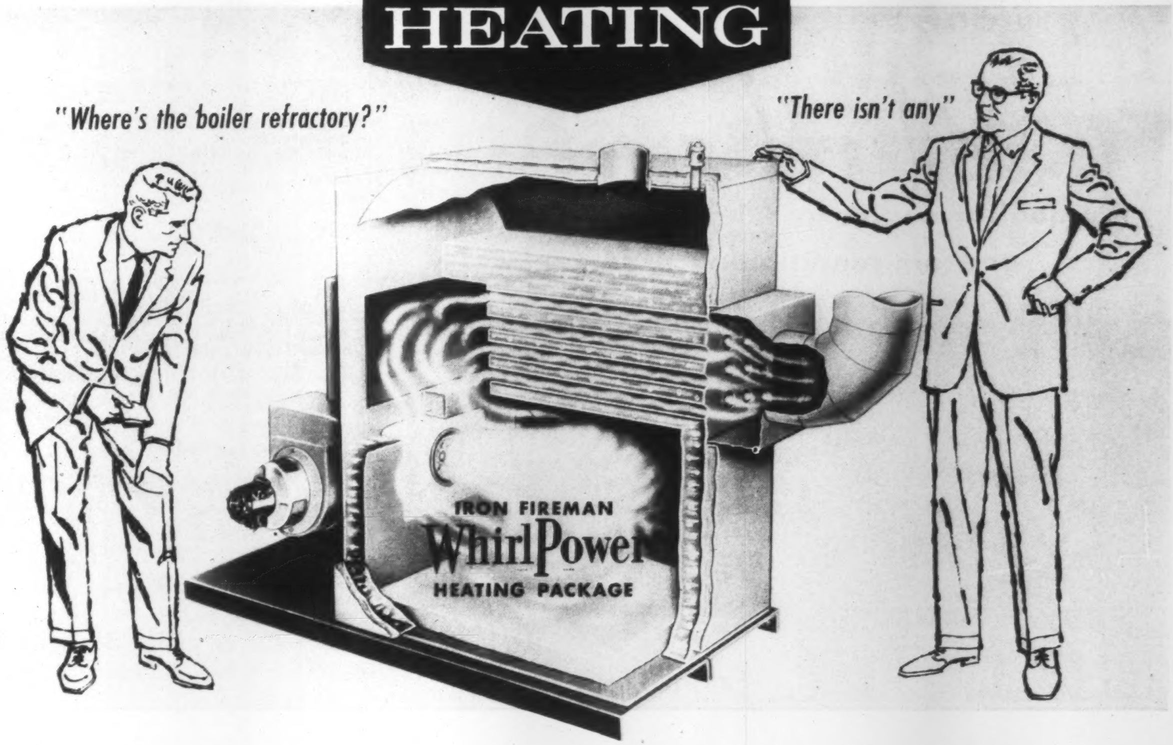
The new world of

HEATING



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No hot refractory needed to support combustion

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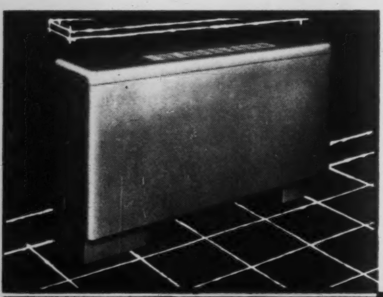

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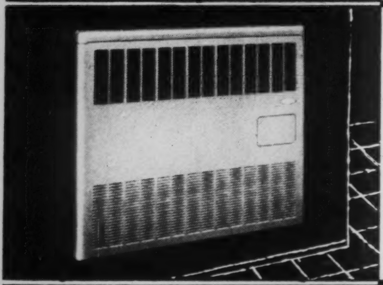

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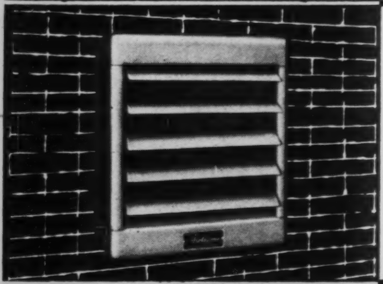

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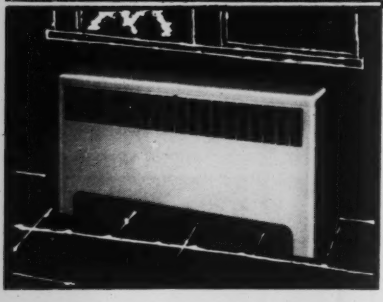

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Saint Louis 77, Missouri

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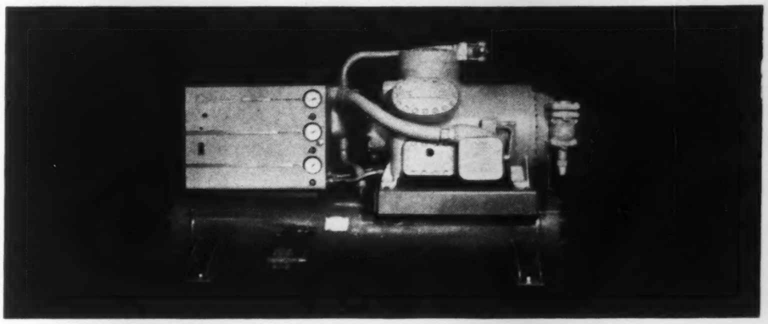
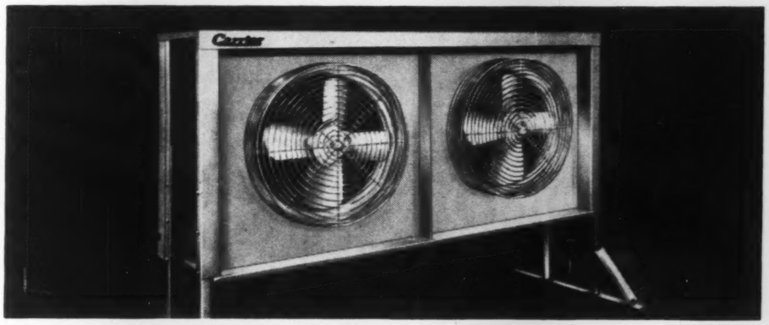
6G AND L HERMETIC CONDENSING UNITS

With the development of the 6L80-83-85, Carrier now offers a complete line of hermetic condensing units with refrigeration capacities from 10 to 145 tons for both air conditioning and refrigeration installations. The 6G and L units, entirely factory assembled and wired, consist of a compressor, motor, water-cooled condenser, safety controls and motor starting and protection equipment. If desired, they can be ordered in models without a water-cooled condenser.



9AB AIR-COOLED CONDENSERS

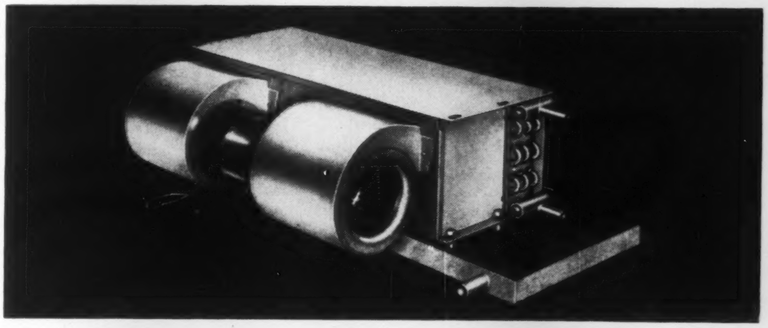
Skillfully engineered, laboratory tested, the new Carrier 15-ton condenser can be mounted on the roof vertically for an extremely low silhouette — or horizontally. Powerful direct drive fans move large quantities of air evenly across the entire surface of the coil — a factor that increases the efficiency by utilizing the full condenser capacity. Other Carrier air-cooled condenser units are available with horizontal discharge in three capacities — 5 tons, 7½ tons and 10 tons.



36W FAN AND COIL WEATHERMAKERS

This portion of Carrier's extensive line of fan and coil Weathermakers* with a single piping system will provide individual control of cooling and heating for multi-room buildings. This versatile unit is for overhead type of installation. It can be concealed or mounted in-the-space with an available metal cabinet. A complete line of control packages can be used to meet the most difficult specifications. The unit comes in 4 capacities: 200, 300, 400 and 600 cfms.

*Reg. U.S. Pat. Off.



For complete details about these new products, see the Carrier dealer listed in the Yellow Pages. Or write Carrier Corporation, Syracuse 1, New York.

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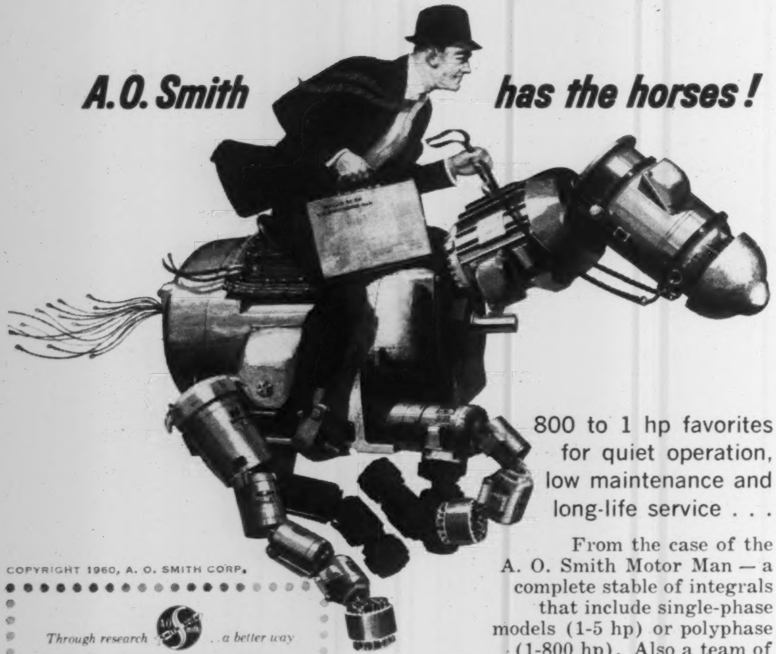
A.O. Smith **has the horses!**



800 to 1 hp favorites
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low maintenance and
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And there's an A. O. Smith Motor Man near you — chomping at the bit to give you 24-hour action on all parts and service orders.

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by Marlo AIR CONDITIONING

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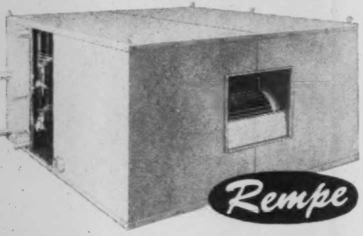
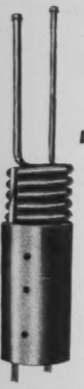


Heating • Cooling • Dehumidifying
Unit illustrated is 15-ton capacity with coil for chilling air to 40° F. and a two row steam reheat coil for tempering air to 70° before leaving unit. Air filters and rack included.
Blower handles 4200 CFM air with 1½ HP motor. Two 7½ ton coil sections may be used together or separately. Steel hot galvanized cooling coils are available for Ammonia . . . Copper tube for Freon or chilled water.



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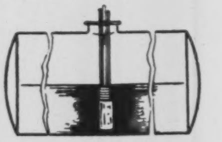

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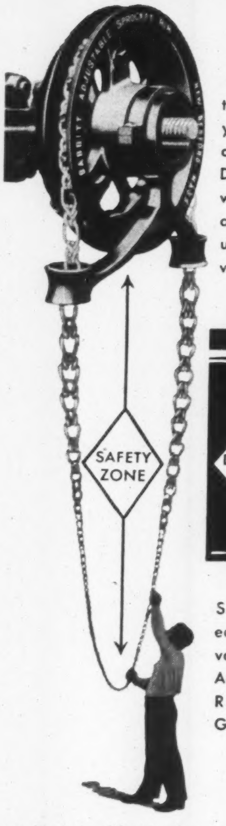

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168-9

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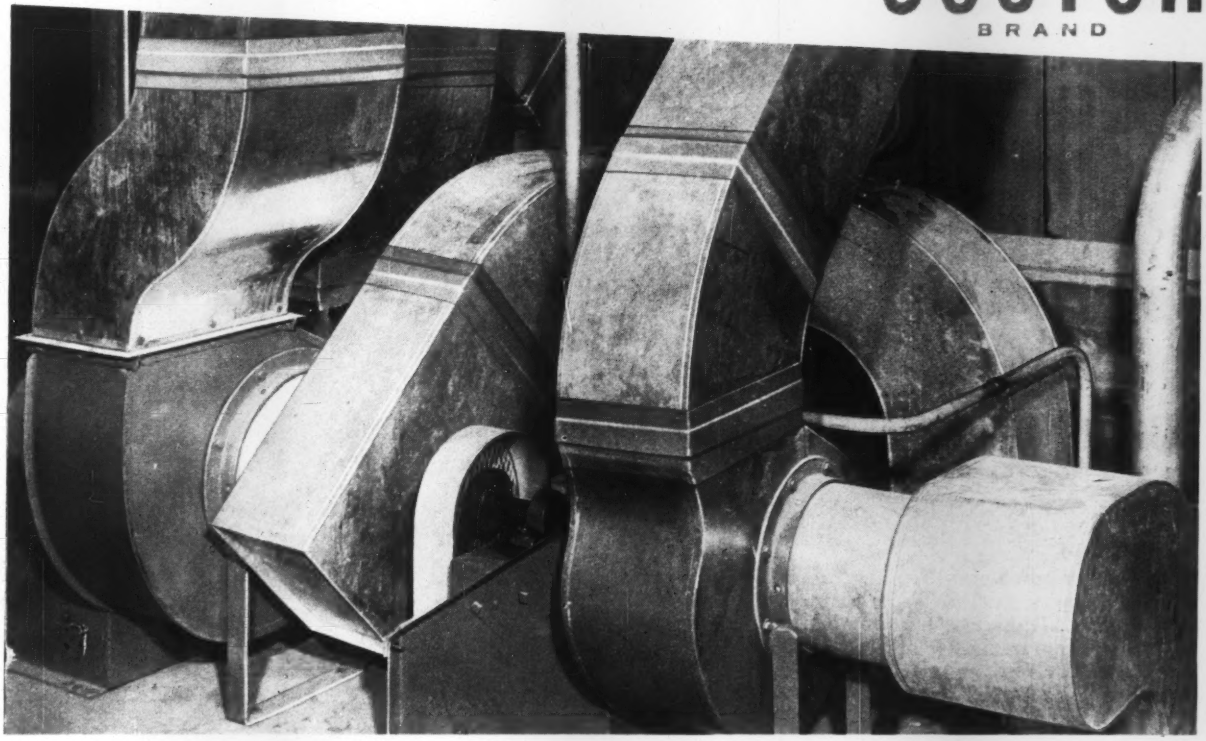
SCOTCH
BRAND



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TAPE EASES DUCT SEALING JOBS...
TRIMS COSTS BY UP TO 50%, TOO!

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you get only with trouble-free UNISTRUT® framing

SAVING #1

Changes—no problem. Meeting unusual job conditions or making field changes can run up costs in a hurry. But not when you use UNISTRUT framing. Completely adjustable, UNISTRUT framing enables you to adjust to any job condition right on the job. Often a wrench is the only tool needed.

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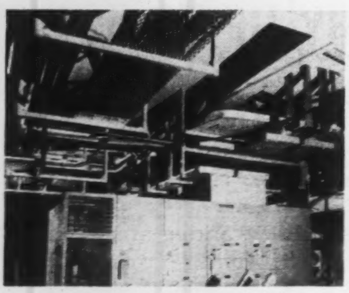
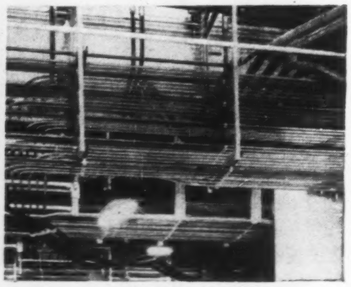
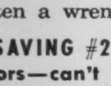
Refineries save *with UNISTRUT framing. No extensive prefabricating, drilling or field fitting was needed to mount the pipe and conduit here. Using the UNISTRUT system, a precision framing and supporting job was done on the job.*



Utilities save *with UNISTRUT framing. Here UNISTRUT drop frames, suspended from UNISTRUT concrete inserts, are used as cable tray supports: same frames also support conduit runs.*



Contractors save *with UNISTRUT framing. In this job UNISTRUT framing enabled close grouping of conduit for a big saving in space. System can be added to or changed at any time.*



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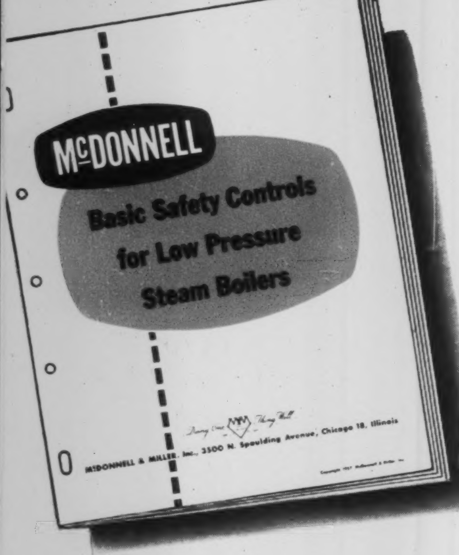
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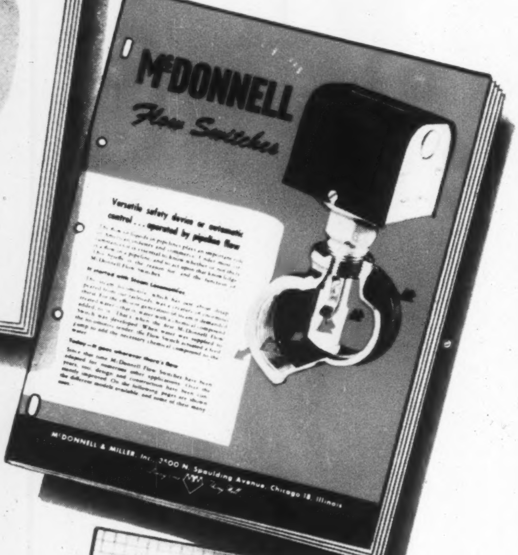
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Heating
Piping &
Air Conditioning

THIS ISSUE IS IN TWO PARTS — PART 2

JUNE 1960

. . . for CONSULTING ENGINEERS • MECHANICAL (Heating, Piping, and Air Conditioning) CONTRACTORS ENGINEERS WITH PLANTS AND BIG BUILDINGS

HEATING, PIPING & AIR CONDITIONING'S

Trade Literature Supplement

HOW TO USE THIS INFORMATION

Catalogs, bulletins, and other helpful data available to you from advertisers in Heating, Piping & Air Conditioning are briefly described in this supplement. Each description is numbered. Just circle the numbers for those you want on the handy postage-paid cards on pages 2-29 or 2-31. Your requests will be passed along to the manufacturers whose literature you ask for.

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Air Distribution, Air Diffusion, Ductwork, Grilles, Etc.

1 **Access Doors, Louvers, Dampers**

Bulletin 120-160-ACC covers insulated duct access doors; adjustable and stationary louvers; air control fire dampers; back pressure dampers; manual, automatic and motorized wall and horizontal shutters. — Ammerman Co., Inc.

2 **Air Diffuser with Diffusing Vanes**

Thirty-two page catalog contains simplified methods for selecting, sizing and applying "Agitair" custom-made air diffusers with built-in diffusing vanes. A few of the unlimited air pattern arrangements are shown, also areas of triangles and trapezoids, table of square and rectangular areas (in sq ft) and typical installations.—Air Devices Inc.

3 **Air Diffusers**

Twelve page bulletin K-27A illustrates and describes "Kno-Draft Architects' Group," comprehensive line of linear and rectangular air diffusers. By drawings, selection and performance tabular matter, illustrations, the "Group's" three types — square, panel, and long-slotted, or linear—are completely discussed. Partial list of users, complete list of sales representatives provided. — Connor Engineering Corp.

4 **Air Diffusers**

Catalog 34 gives complete list of ceiling and wall outlets — diffusers for commercial air conditioning. — Universal Diffuser Corp.

5 **Air Diffusion Equipment**

Fifty-eight page catalog 1-59 contains complete application and specification data on Waterloo's line of return and supply registers, extruded aluminum "Airline" grilles, removable core grilles, volume control dampers and door ventilators. Each type of unit is well illustrated and keyed in color for quick reference. — Waterloo Register Co., Inc.

6 **Air Distribution Products**

Complete catalog illustrates Titus "Airfoil" registers, grilles, ceiling diffusers, linear diffusers and all accessories for air distribution. Includes complete engineering and performance data and price lists. — Titus Mfg. Corp.

7 **Air Duct**

Twelve page brochure TR-198A describing and illustrating the use of Johns-Manville asbestos-cement "Transite" air duct in loop, radial and lateral types of perimeter heating-cooling systems. Gives job data, system design diagrams, facts and photographs about factory-made and segmental fittings, methods of cutting, assembling etc. — Johns-Manville Sales Corp.

8 **Air Turning Devices**

"Uni-Flo Airturn" is a factory-fabricated, ready-to-install air turning device designed to give sweeping radius performance to the square duct corner. In addition to describing and illustrating it, catalog F-7912-1 includes pressure loss data to permit determining elbow losses throughout system, sizing and ordering information. — Barber-Colman Co.

9 **All-Air High Velocity Units**

Catalog contains descriptions of various systems for diffusing high velocity air in air conditioning installations. Shown in this catalog, in diagram form, are typical applications of high velocity units. Included are dimension drawings and tables as well as cfm capacity, static pressure and radius of diffusion rating for every available diffuser size. — Anemostat Corp. of America

10 **Circular Diffusers**

Complete application data, roughing-in dimensions and description of available accessories for fixed pattern and adjustable pattern "Silentair" circular and half-round diffusers given in bulletin C-600. Units are suitable for recessed ceiling mounted and exposed duct mounted applications. — General Air Products Corp.

11 **Cloth Tape**

Two page detailed description of "Permacel" 691 silver cloth tape used in sealing duct work. Illustrated application procedure. — Permacel

12 **Combination Light and Air Diffuser**

Barber-Colman and Day-Brite Lighting, Inc. have compiled a twenty-four page catalog describing a new combination light and air diffuser. The book (F-9768) briefly gives a history of the evolution of lighting and air distribution. Accurate performance data, selection charts and background sound level tables are included. — Barber-Colman Co.

13 **Corrosion Resistant Sheet Stock**

Full description of "Boltaron" polyvinyl chloride 6200 and 7200 sheet and applications. Available in 30 × 60 in. sheet, gauges 1/32 to 1 in.; 48 × 56 in. sheet, gauges 1/32 to 1 in.; welding rod 3/32, 1/8, 5/32 and 3/16 in. — Bolta Products Div., The General Tire & Rubber Co.

14 Dampers, Louvers, Sheet Metal Specialties

Catalog features the Imperial VWNYT-1 fire damper, now produced under the factory inspection and label service of the Underwriters' Laboratories, Inc., and also briefly describes line of high pressure dampers, automatic and manual dampers, extruded aluminum louvers, stationary and adjustable louvers, automatic and backdraft dampers. — Imperial Damper Co.

15 Diffusers

Industrial "Venturi-Flo" diffusers provide the full range of air pattern adjustment which is essential to human comfort. A new catalog (F-7722-1) is now available which includes descriptive data, dimension drawings, and performance data, permitting the engineer to determine installation requirements. — Barber-Colman Co.

16 Diffusers

"Silentair" series S square, rectangular and continuous diffusers together with available accessories are described in bulletin S-401. Extensive application data is included in revised, more easily readable form together with roughing-in dimensions for various styles of frames and mountings. — General Air Products Corp.

17 Drill Screws

Four page bulletin describes new "Drill-Screw" that drills its own hole in sheet metal. Manufactured in five sizes. Tips on "Drill-Screws" and drill chucks are given, and net prices are shown. — Duro-Dyne Corp.

18 Dual Duct Air Conditioning Air Mixing Units

Sixteen page bulletin DD-6 gives information on dual duct air mixing units for use in high or low pressure dual duct air conditioning systems with supplementary items such as enclosures, distributing headers, high velocity outlets, etc. — Buensod-Stacey, Inc.

19 Engineering Catalog

This book offers descriptions, properties, chemical resistances, detailed specifications and installation data covering polyvinyl chloride pipe, fittings, valves and sheet stock. — The Colonial Plastics Mfg. Co., Van Dorn Iron Works

20 Extruded Aluminum Grilles

Technical catalog LD-100 contains performance data, selecting and sizing methods of "Agitair Decoraire" extruded aluminum grilles in 12 sizes with three degrees of deflection (0, 15 and 25 deg) and in widths of 1½, 2, 3, 3½, 4, and 6 in. Catalog also illustrates a group of modern design extruded aluminum borders. — Air Devices Inc.

21 Fabricated Grilles

Bulletin 43 illustrates, describes Diamond heavy-duty bar type grilles — all steel or all aluminum — designed and built to give best possible combination of strength and high open area. Widely used in modern schools, colleges, hospitals, ocean liners, sports arenas, etc. Built to order (no standard sizes) in any required rectangular size or shape. — Diamond Mfg. Co.

22 Fabricated Plastic Ductwork

Plastic ductwork for handling wet or corrosive fumes is described in new "Ace" bulletin CE-59. Corrosion-resistant, light in weight, the polyvinyl chloride and other plastics used are good for a lifetime with no painting or maintenance required. Tanks, hoods, stacks, large pipe and fittings also available. — American Hard Rubber Co., Div. Amerace Corp.

23 Fiber Duct

A four page illustrative brochure on "Sonoair-duct" fiber duct. The duct is designed particularly for slab floor perimeter heating or combination heating and cooling systems. Information regarding air friction loss, thermo-conductivity and general installation instructions are included in the brochure. — Sonoco Products Co.

24 Flame Resistant Barriers

Folder contains descriptive information, technical data and actual samples of "Pyro-Kure", flame resistant vapor barriers for duct and insulation facing and pipe jacketing. Underwriters' Laboratories ratings and physical property summaries are also included. — American Sisalkraft Corp.

25 Glass Fiber Duct Lining

Mundet "Supertex" glass fiber duct lining is strong, resilient, lightweight, semi-rigid insulation consisting of fine, flame-blown inorganic glass fibers, treated on one side to resist possible surface erosion in high velocity systems. Highly effective in absorbing sound, resisting heat transfer. Bulletin has data tables, specifications, application instructions. — Mundet Cork Corp., Insulation Div.

26 Grilles

Catalog 36, 100 pages (AIA File No. 30-E) illustrates, describes Diamond architectural grilles, stamped out of steel, aluminum, bronze or any

Use the handy postage-paid reply cards on pages 2-29 and 2-31 to request copies of the catalogs, bulletins and other data you'd like to have.

other commercial metal, in any thickness up to ¼ in. Shows unit openings actual size, gives complete working data. Illustrates, describes other Diamond products for heating, ventilating, air conditioning. — Diamond Mfg. Co.

27 Grilles and Registers

"Customline" extruded grilles and registers designed for the most exacting architectural treatments are described in bulletin E-500. A "selection guide" is included in this up-to-date bulletin to indicate readily the wide range of application and method of selection to meet specific problems. Descriptive information and application data are included. — General Air Products Corp.

28 Multi-Blade Dampers

Chart tells how to make multi-blade dampers, using "Duro-Blade" kit for parallel dampers and "Opax" blade kit for opposed action dampers. Ordering information, how to make the frame and the blades, mounting the hardware, and assembling the damper are covered. — Duro-Dyne Corp.

29 Perimeter Diffusers

Four page circular, form 101, on U. S. perimeter base diffusers, and perimeter base intakes. Also covers diffuser sidewall and base registers, and floor registers and diffusers. Features described and illustrated, dimensional data tabulated, list prices given. — United States Register Co.

30 Products for Sheet Metal Industry

Bulletin describes rails for fabricating duct turning vanes and louvers — "Instant-Vane-Rail," "Scoop Rail," and "Louverail." — Cain Mfg., Inc.

31 Registers and Grilles

Carnes Corp. catalog 76-E is adequately illustrated with square and rectangular registers and grilles, accessories and engineering data. Both multi-blade and opposed blade dampers are available for the Carnes line; both dampers are face-operated. — Carnes Corp.

32 Registers and Grilles

Catalog 58 describes "Fabrikated" adjustable bar registers and grilles for cooling and air conditioning. Volume control blades. — The Independent Register Co.

33 Registers and Grilles

Complete list of ceiling and wall registers and grilles for commercial air conditioning, also door grilles, is given in catalog 39. — Universal Diffuser Corp.

34 Registers, Grilles and Diffusers

Registers, grilles, and diffusers for heating, cooling and ventilating applications are described in catalog 61. — A-J Mfg. Co.

35 Regulators, Dampers, Registers, Grilles and Diffusers

A complete line of manually controlled surface, concealed, high pressure, floor-line, remote control and air-split regulators; dampers; adjustable air conditioning registers, grilles and baseboard diffusers, for every type of heating and air conditioning installation. — Young Regulator Co.

36 Round and Square Ceiling Diffusers

Four page bulletin describes round and square ceiling diffusers in step-down and flush-type styles, and round and square ceiling dampers, knob and screwdriver operated. Equipment is illustrated, cross-sections shown, and free areas, dimensions, prices given. — United States Register Co.

37 Sheet Metal Specialties

Eighteen page catalog describes flexible duct connectors, vane rail, blade kits, damper regulators, other specialties, new "Drill Screw"; new ⅜ in. regulator set called "Wedge-Loc"; new plastic air flow regulator, called "Duro-Trol," for installations in exposed areas; and new adhesive for attaching insulation to duct work, known as LA-11. — Duro-Dyne Corp.

38 Square Air Diffusers

Catalog contains principles and definitions of air diffusion terms. It contains detailed data on the selection of square air diffusers. Included are dimension drawings and tables as well as cfm capacity, static pressures and radius of diffusion rating for every available diffuser size. — Anemostat Corp. of America

39 Square and Rectangular Diffusers

The Carnes Corp. offers catalog 859 on square, rectangular, and "in-line" ceiling diffusers. Diffusers furnished in one, two, three and four way blows with six frame designs to fit all types of ceiling applications. Catalog contains engineering and performance data. — Carnes Corp.

40 Straight Line Air Diffusers

Catalog contains principles and definitions of air diffusion terms. It contains detailed data on the selection of straight line air diffusers. Included are dimension drawings and tables as well as cfm capacity, static pressure and radius of diffusion rating. — Anemostat Corp. of America

41 Valve Attenuator

Bulletin K-45 describes the new Connor "Kno-Draft" series 45P valve attenuator, which uses no motors or linkage of any kind, and is designed for use in dual duct high velocity air distribution systems. Features are listed, function explained and diagrammed, performance data, dimensions, and specifications are given. — Connor Engineering Corp.

Air Filters & Air Cleaners

42 Air Cleaners

Four page technical bulletin describing physical properties and uses of flat "Ulok" replacement air filter introduces new and advanced materials and designs to filter air efficiently. Also included are graphs depicting effectiveness of the air filter. — Union Carbide Development Co., Div. of Union Carbide Corp.

43 Air Cleaning

AFI data sheet, "Streaking and Smudging Around Air Outlets." — Air Filter Institute.

44 Air Filters

Fram permachem-treated air filters, bactericidal disposable type filters for air conditioning, heating and ventilating systems, described in bulletin entitled "Better Three Ways." — Fram Aire Corp.

45 Air Filters

Catalog shows graphs, charts, and other technical data on "Dust-magnet" electrostatic air filters with "Poly-mag 80." — Stoddard Industries, Inc.

46 Automatic Roll Type Air Filters

Eight page bulletin 819 describes Continental "Conomatic" type G roll-away air filter, using a 65 ft long disposable media blanket fed from the underside of a free-rolling spool at the top of the unit. Features are described and illustrated, specifications given, and cfm ratings tabulated. — Continental Air Filters, Inc.

47 Catalytic Purifiers

Twenty-two page publication (1501) describing MSA catalytic purifiers for air separation plants, jet aircraft, and other special applications. — Mine Safety Appliances Co.

48 Disposable Air Filters

Farr HP high efficiency, strainer type filters developed to operate at lowest pressure drop while providing highest efficiency and dirt holding capacity described in bulletin B-1300-4. The deep pleats of media provide large area within compact, pre-formed filter cartridge. Three interchangeable HP filter cartridges available to meet varying efficiency requirements. — Farr Co.

49 Dry Type Air Filters

Eight page bulletin 431 describes Continental "Dycon" extended surface, permanent, dry panel filters with 8 in. deep bed. Two models available, with ratings of 1000 cfm and 800 cfm. Details, specifications, and features are presented. — Continental Air Filters, Inc.

50 Electronic Air Cleaner and Air Filter

Catalog 249 describes the new AAF "Rollotron" electronic air cleaner. The "Rollotron" combines into one unit an electronic plate type precipitator and automatic renewable media filter. Operates with dry plates on the agglomerator principle. Electronic efficiency with no washing, no oiling, no water, no drains. — American Air Filter Co. Inc.

51 Electronic Air Cleaner Specification Manual

Includes specifications for Honeywell's "Selector" series of electronic air cleaners. In addition, directions on how to select an electronic air cleaner. It presents the information so that the air cleaner can be sized by capacity, size-shape configuration, or physical dimensions. Important air system considerations when using electronic air cleaner included. — Minneapolis-Honeywell Regulator Co.

52 Electronic Air Cleaners

AFI data sheet, "The Application of Electronic Air Cleaners," published in the interest of better air cleaning by the Air Filter Institute. — Air Filter Institute.

53 High Efficiency Air Filtration

Bulletin 121A shows comparative atmospheric dirt concentrations by count, area and weight and comparative efficiencies of various types of air filters. Illustrates and describes Cambridge "Absolute," "Aerosolve" and "Micretain" filters, combination "Aerosolve"-charcoal filter frames and filter-blower units. — Cambridge Filter Corp.

54 High Velocity Panel Air Filters

The Farr type 44 panel filter described in bulletin B-100-2B is all metal cleanable high velocity (350-690 fpm) viscous impingement filter, constructed of alternate layers of flat and crimped screen wire cloth coated with oil base adhesive. For ventilating and air conditioning, as well as paint, moisture, and grease elimination. — Farr Co.

55 Horizontal Roll Type Air Filters

Eight page bulletin 822 is devoted to Continental type GH horizontal "Conomatic" roll-away air filter for use where the duct or plenum opening is 3 to 5 ft in height. It can be installed to filter air moving either in a horizontal direction or vertically upward. Features explained and illustrated, and specifications and ratings given. — Continental Air Filters, Inc.

56 **Pull-Down Filters**

Technical catalog DS-100 contains complete performance data, sizes, installation and maintenance savings of the new series of "Agitair" type DS (Definite Seal) manually pull-down filters. The media, nominal 2 in. glass fiber blanket, has been thoroughly laboratory tested for excellent efficiency and high dust holding capacity. — Air Devices Inc.

57 **Renewable Media Air Filter**

Traveling renewable media air filter that renews the media through manual operation described in bulletin B-1400-6. Designed to operate in pressure differential range from 0.3 to 0.6 in. of water, and from 350 to 500 fpm, the Farr "Manual Roll-Kleen" was developed for high performance, low cost installation. — Farr Co.

58 **Replacement Air Filters**

Four page technical bulletin describes physical properties and uses of "Ulok" replacement air filter of "Cube" type. The cube shape presents more filtering surface (1020 sq. in.) to the air stream, providing for higher efficiency over far longer life with unusually low pressure drop. — Union Carbide Development Co., Div. of Union Carbide Corp.

59 **Space Filters**

Sixteen pages of descriptive data (1505-6-993697) on the new MSA line of "Dustfoe" medium efficiency panel filters, 85 to 95 percent on the NBS atmospheric air dust stain test. — Mine Safety Appliances Co.

60 **Space Filters**

Sixteen page publication (1505-5-993698) describing the MSA "Ultra-Aire" line of high efficiency panel filters for aerosols, 99.97 percent on the Chemical Corps DOP Test. — Mine Safety Appliances Co.

61 **Test Code for Air Cleaning**

Code for testing air cleaning devices used in general ventilation, an analysis of the AFI test code and an explanation of AFI's new air filter test code. — Air Filter Institute.

Atomizing & Spray Nozzles

62 **Industrial Nozzles**

An 18 page catalog covering complete line of spray nozzles for industrial applications. Made of brass, stainless, Monel, hard rubber, Teflon in a wide range of pipe and capacity sizes, hollow and solid cone, wide and narrow spray angles. — Monarch Mfg. Works, Inc.

63 **Industrial Spray Nozzles**

Bulletin 5900 describes in detail nozzle selections, capacity and spray data, as used in all forms of refrigeration and air conditioning equipment in which nozzles are included as an integral part, as in evaporative condensers, air washers, cooling towers and related heat exchange apparatus. Humidifying nozzles for direct penetration into open room space are also included. — Binks Mfg. Co.

64 **Oil Burner Nozzles**

A 12 page catalog covering stainless steel domestic oil burner nozzles as well as hardened steel nozzles for heavy oil, variable capacity "bypassing" nozzles, air operated nozzles and oil burner air mixing equipment. — Monarch Mfg. Works, Inc.

Cements, Adhesives & Tapes

65 **Adhesives**

Bulletin describes "Tuff-Bond" general purpose, for installing "Gemco" (metal) insulation hangers; "Quik-Set" for installing "Tuff-Weld" (nylon) insulation hangers; No. 6 non-flammable duct liner; No. 7 duct liner; No. 12 high velocity air duct; No. 21C clear lap sealer; No. 21W white lap sealer, and No. M-102-H duct liner. — Goodloe E. Moore, Inc.

66 **Adhesives for Insulation**

Technical data and performance information on adhesives for high and low density insulating materials used primarily on ducts is presented in a bulletin. Also included in publication is information about seam sealers developed for use with both high and low velocity duct systems. — Minnesota Mining & Mfg. Co.; Adhesives, Coatings & Sealers Div.

67 Adhesives for Insulation

Four page, two color "Mira" data sheet 11 lists Miracle adhesives used for insulation. — Miracle Adhesives Corp.

68 Color Code Identification and Pipe Sealant

Leaflet P-PPCCL describes "At-a-glance" color coding for pipe and duct systems. Also pipe sealing. — Minnesota Mining and Mfg. Co.

69 Corrosion Control of Buried Piping

The Chase "Corr-Prev" system of protective tape coatings embodies four pipe coating items — "Chaseprime," "Chasefil," "Chasekote" (tape) and "Chasewrap" (overwrap). In combinations with "Tapechasers" (application machines) this system offers a complete package for corrosion control of buried piping structures. Described in 4 page folder HCG 7369. — Chase & Sons, Inc.

70 Holding and Insulation Tape

Catalog sheet MP-26 on metallized paper insulation tape, a multi-purpose holding and insulation tape having excellent resistance to water and abrasion, good resistance to solvents, and good resistance to oil. Applications include holding insulation to ductwork and sealing building insulation blankets. — Shuford Mills, Inc.

71 Insulating and Sealing Type

Catalog sheet LF-65 on foil laminated to kraft "Shurtape" high adhesion insulating and sealing tape with excellent resistance to water and abrasion, good resistance to solvents, and fair resistance to oil. One application is for holding insulation to ductwork and holding roofing and building insulations. — Shuford Mills, Inc.

72 Masking Tapes

Leaflet describes "Shurtape" masking tapes of various types, including general purpose, stain resistant, and high temperature. Each is engineered with special features to meet special job requirements, it is pointed out in the leaflet. — Shuford Mills, Inc.

73 Plastic Tapes

General use booklet P-PTPFR describes "Scotch" brand plastic tapes for sealing, masking, coding, lane marking, etc. — Minnesota Mining and Mfg. Co.

74 Pressure Sensitive Tapes

Eleven page booklet HCG 8798, entitled "Typical Specifications of the Tape Coating Constructions used on Cylindrical Exterior Surfaces," offers a complete delineation of the various product property and application requisites for successful utility of tape coatings and accessory products for corrosion control with pressure sensitive tapes. — Chase & Sons, Inc.

75 Products for Sheet Metal Industry

Bulletin covers "Fastak," "Ductak," and "Safetak," duct insulation adhesives; "Caintape" duct tape; "Cliptak" stick clip adhesives; and "Sealtak" high pressure duct sealer. The products are described, and their applications are indicated. — Cain Mfg., Inc.

76 Tapes and Adhesives

Complete catalog of "Permacel" tapes, adhesives, dispensers. Gives outstanding product features, uses, descriptions. — Permacel.

Controls & Instruments

77 Air Adjusted Pilots for Pressure Control

Response curves, application diagrams and selection data for new series of pressure pilots for control in vacuum range. Remote adjustment air control as well as complete specifications for air loaded pressure pilots described in bulletin which is identified as S.E.M. 9. — Spence Engineering Co., Inc.

78 Air Control Temperature Regulators

Cascade control with air signal to pressure regulator modulates steam flow to meet wide-ranging demands of heat exchangers. Wide adjustable temperature ranges, fast response, low air consumption described in bulletin which is identified as S.E.M. 9. — Spence Engineering Co., Inc.

79 Automatic Heating Controls

Seventy-two page catalog of automatic controls for domestic/commercial heating and appliance applications. Carefully indexed and illustrated with room thermostats, gas valves, oil primary controls, package sets for gas and oil heating, limit controls, water heater thermostats, relays and other products. — General Controls Co.

80 Barometric Draft Control

Twenty page handbook and installation guide for barometric draft control explains why draft must be controlled, where to install a draft control, selecting the right size, how to install, and use of instruments in setting a control. Detailed information on several controls included. — Field Control Div., Conco Engineering Works, Inc.

81 Centralized Control Systems

Bulletin explains the advantages of Honeywell centralized control systems in reducing operating costs and improving system performance. Describes centralized control for multi-story buildings, smaller buildings, and fan rooms. Also explains "Honeywell field service." — Minneapolis-Honeywell Regulator Co.

82 Control Valves

Catalog 98316 aids in selecting the proper valve (or lever motor), which is the final element in automatic process control. This requires careful consideration of many factors. To help choose the valve size, material, construction, and action most suitable to application, there is a section entitled "How To Select a Control Valve." — Taylor Instrument Companies.

83 Dial Thermometers

Catalog 205 describes dial thermometers, the supertherm line, 4½, 6 and 8½ in. mercury, gas, organic liquid or vapor actuation and available in choice of four case styles, with direct or remote design, adjustable angle. Also describes temperature switches and alarms. — United States Gauge Div.

84 Eccentric Valves

Eight page bulletin 110 describes the eccentric principle under which DeZurik valves are designed. It also lists the dimensions, wide variety of materials, etc., of the manually-operated DeZurik valves used on air conditioning installations. — DeZurik Corp.

85 Gauges

A 112 page catalog illustrates and describes all types of "Ashcroft" gauges for pressure, vacuum, and compound. Also gauge testers, recording gauges, and many special application types. — Manning, Maxwell & Moore, Inc.

86 Gauges and Needle Valves

Catalog 76-G lists the entire line of Marsh gauges for all types of industry, including heating. Detailed listings insofar as ranges and sizes, as well as line drawings giving roughing-in dimensions of all of the gauges shown, are included. — Marsh Instrument Co., Div. of Colorado Oil and Gas Corp.

Over 600 catalogs, bulletins and other publications available to you on request are described in this supplement to Heating, Piping & Air Conditioning. Forty of them fall under the general classification of "Controls & Instruments."

There are 30 such general classifications, as indexed on the front cover of this supplement. Each of the over 600 items grouped within these broad classifications also has its own title, for your convenience in finding the literature you want.

87 Heating Control Systems

Weather compensating Sarcotherm catalog ST500-1 of control systems and components for hot water and radiant heating systems. Complete with technical data and roughing-in dimensions. — Sarcotherm Controls, Inc.

88 Industrial Controls

Ninety-two page catalog of automatic controls for commercial, industrial plant, or process requirements — with specifications, diagrams, application data for engineers. Includes "Hydramotor" electro-hydraulic valves and actuators, "Tork-Master" electric valve operators, "Hammel-Dahl" air operated proportioning valves and "Foster" steam specialty and regulator valves and flow tubes. — General Controls Co.

89 Industrial Thermometers

An 84 page catalog illustrates and describes all types of "American" dial, industrial glass and recording thermometers. Every type of actuation available in F and C ranges. — Manning, Maxwell & Moore, Inc.

90 Industrial Thermometers

Catalog 101, on industrial thermometers, for direct mounting, available in case sizes 7, 9 or 12 in., and submarine type 5 in. Choice of mounting angles, plus versatile "Multi-Angle" type, mountable at any angle, and special types for frost insulation, air ducts and superheaters, are described. — United States Gauge Div.

91 Instrument Manual

The Dwyer 72 page instrument manual covers a complete line, including many new gauges. Air filter gauges, complete combustion test kits, and various manometers, including one that will roll up to fit compactly in tool box. Flow meters, pressure switches, pitot tubes, special instruments and wind speed indicators are covered. — F. W. Dwyer Mfg. Co.

92 Instrument Tubing

Sixteen page booklet 4412 describes various types of "Dekoron" tubing for use in instrumentation, such as plastic tubing, plastic tubing bundles, plastic coated metal tubing, plastic coated metal tubing bundles. — Samuel Moore & Co., Dekoron Products Div.

93 Liquid Level and Flow Control

Bulletin ERS-A, on special applications of McDonnell products, covers a wide variety of liquid level and flow control applications — on standby pumps, hydro-pneumatic tanks, water chillers, proportioning systems, etc. All in all, there are 21 specific case studies and each one can suggest others. — McDonnell & Miller, Inc.

94 Magnetic and Motorized Valves

Mercoid magnetic and motorized valves for air, water, gas, oil and refrigerants are described in catalog V-58. — The Mercoid Corp.

95 Mercury Switch Controls

Mercury switch equipped controls for single stage pressure, two stage pressure, differential pressure, single stage temperature, two stage temperature, liquid level and mechanical movement are covered in catalog 860. Also illustrated are transformer-relays and a complete line of tilting and magnetic hermetically sealed mercury switches. — The Mercoid Corp.

96 Moisture and Liquid Indicator

Bulletin 70-10 gives details of Sporlan "See.All" moisture and liquid indicator. Tells how it may be used to provide constant protection against moisture in refrigeration system by observing color of indicator dot in sight glass. Bulletin also contains complete application and installation instructions, tells how it may also be used in a bypass. — Sporlan Valve Co.

97 Moisture-Liquid Indicator

Bulletin 60-2021 on "Dri-Vue" moisture liquid indicator covers single and double port types. These refrigerant moisture-liquid indicators can be read at a glance. The large viewing element detects moisture by color variation plus spelling out words "Wet" or "Dry." Connections available M flare by M flare, M flare by F flare and OD solder, 1/4 through 2 1/8 in. — Henry Valve Co.

98 Motor Control

Condensed price catalog listing the commonly used motor control up to and including the size 4 rating, plus pushbuttons, limit switches, and other accessories. — Allen-Bradley Co.

99 Motor Control Selector Chart

The several pages in this chart give a quick reference to the most popular types of pushbutton stations, manual and magnetic starters, overload heaters, etc., arranged conveniently according to the horsepower of the motor with which these controls are to be used. — The Arrow-Hart & Hegeman Electric Co.

100 Motor Controls

Handy reference catalog 14 consisting of 78 pages lists in condensed form the principal lines of Arrow-Hart motor controls. A table of contents appears on page 1 and includes such items as manual starters, magnetic relays, contactors, reversing contactors and starters, pushbutton stations, as well as others. — The Arrow-Hart & Hegeman Electric Co.

101 Pneumatic Control Centers

Bulletin S-103 describes the functions, applications, and operation of centralized pneumatic controls for air conditioning, heating, and ventilating systems. The advantages of using pneumatic transmission are explained and the latest developments in control center instrumentation are shown in this 12 page booklet. — Johnson Service Co.

102 Pneumatic Control Systems

Bulletin M-101 explains the principles of pneumatic controls for heating, cooling, ventilating, air conditioning, and industrial processes. Controllers and controlled devices are shown in detail. Bulletin also covers typical applications that range from the simple thermostat-valve arrangements to complex dual duct control systems. — Johnson Service Co.

103 Pressure Regulators

Bulletin 160 illustrates and describes "Precision" pressure regulators, types AA and AR, and IA and IR suitable for steam or air service with either 300 lb bronze or 250 lb semi-steel body with stainless steel unit pilot valve, main valve and seat, sizes 1/2 through 6 in. — O. C. Keckley Co.

104 Pressure or Temperature Recorders

Catalog 800 on pressure or temperature recorders, 12 in., describes such features as modern style case with stainless steel escutcheon plate, shelf to permit easy removal of connections, largest chart opening in industry, and others. — United States Gauge Div.

105 Pressure and Temperature Switches

Bulletin 876-877 describes pressure and temperature switches for the refrigeration and air conditioning industries. — Allen-Bradley Co.

106 Pushbuttons, Selector Switches

Publication 6090 covers pushbuttons, selector switches, pilot lights, enclosures, and flush plates. — Allen-Bradley Co.

107 Recorders

Catalog 98286 describes "Transcope" 90J series recorders for recording or indicating three process variables. Provides set point transmitter, automatic-to-manual and cascade switching levers; transmitter, controller, process output and cascade indicators. "Servomatic" motors with 150 times more power for pen positioning permit integral high-low electric or pneumatic alarms. — Taylor Instrument Companies.

108 Reduced Voltage Starters

PRA starters described in catalog section are used to limit the inrush of starting voltages to a-c motors. They are designed to reduce the strain on motor driven machinery or to reduce disturbances caused by heavy starting current. — The Arrow-Hart & Hegeman Electric Co.

109 Refrigerant Valves and Controls

Condensed catalog 20 has descriptive and capacity data on thermostatic expansion valves, refrigerant distributors, solenoid valves, suction line regulators, flooded evaporator controls, reversing valves, and miscellaneous products. — Alco Valve Co.

110 Regulators, Dampers, Registers, Grilles and Diffusers

A complete line of manually controlled surface, concealed, high pressure, floor-line, remote control and air-split regulators; dampers; adjustable air conditioning registers, grilles and baseboard diffusers. — Young Regulator Co.

111 Relative Humidity Transmitter

Catalog 98338 presents the 207T series transmitters which measure the relative humidity around an integral sensing element and convert this into a proportional air pressure output signal. The signal from this non-indicating, pneumatic motion-balance instrument can be transmitted to a receiving indicator or recorder and controller. — Taylor Instrument Companies.

112 Standard Mercury Thermostats

New line of "Vap-Air" standard mercury thermostats featuring low cost and 30 day delivery are described in 18 page bulletin 684. Three standard merc thermostat groups are described — the well type for sensing case temperature, the duct type for gas or fluid temperature sensing, and the surface type for "area contact" temperature sensing. — Vapor Heating Corp.

113 Tank Level Gauges

Dial type tank level gauges are described in bulletin 463A. Remote indication features completely self-contained hydraulic transmission system. — Liquidometer Corp.

114 Temperature and Pressure Instruments

General catalog 101M lists complete line of temperature and pressure instruments for indicating, recording and controlling temperature, pressure and humidity. The line is complete, includes industrial, dial indicating and recording thermometers for all services, between the ranges of minus 40 and plus 1000 F. Can be supplied in vapor, gas or mercury actuation. — H. O. Trerice Co.

115 Temperature Regulators, Valves, Expansion Joints

Robertshaw temperature regulators for heating, ventilating and air conditioning described in catalog B. Self-operated vapor pressure, hot chamber types. Pneumatic and electrically actuated types to provide controller, positioner, valve in one unit. Automatic radiator valves for room control. Packless expansion joints for water and steam, working pressures to 150 psig. — Fulton Sylphon Div., Robertshaw-Fulton Controls Co.

116 Zone Heating Valve

Four page color brochure describes operation of "Zonvalve" thermostatically controlled zone heating valve. Cutaway views show mechanical features, cartoons illustrate ease of installation and operation. Layouts show typical installations on radiators, convectors and supply lines. Photos of all models and accessories. — Heat-Timer Corp.

Drying & Process Equipment

117 Boilers and High Temperature Heaters

Eight page catalog AD 167 showing dimensions, ratings, specifications on packaged boilers and high temperature heaters. Industrial "Peak-Temp" oil heater heats to 600 F at low pressure; oil, gas, combination fired units. Vaporizer for "Dowtherm" has output to 8,000,000 Btu per hr for process heating, 375 F to 700 F. — Cleaver-Brooks Co.

118 Carbon Steel Heat Exchanger Tubes

Eight page catalog TB-431 briefly describes the many factors which make B&W "Lectrosonic" welded tubing the new standard of quality in heat exchanger tubing. The catalog contains specifications and data on "Lectrosonic" tubes, and illustrates the quality control equipment which governs each step in tube manufacture. — The Babcock & Wilcox Co., Tubular Products Div.

119 Dryer

Campbell dryer is described in bulletins 548, 571, 550. — Campbell Heating Co.

120 Dryers and Processing Equipment

"A&R" dryers, individually designed to meet customers' specifications, are described in section

70. Built of sub-assemblies, factory test erected and match-marked, they are assembled in the field at minimum cost. Featuring ease of access, servicing and durability, these dryers may be designed to meet most requirements. — Air & Refrigeration Corp.

121 Industrial Fans

Bulletin EX-531 covers industrial type EX fans for corrosive, abrasive or hazardous service conditions by the use of coatings, linings, special metals or special construction. These fans are available with usual accessories such as flanged connections, drains, access doors and others. — Bayley Blower Co.

122 Low Temperature Dryers

Two color brochure K-156, "Engineered Drying," describes new Surface high speed, low temperature dryers for continuous drying processes. Continuous dryers replace batch operation in production of glue and gelatin, dairy products, chemicals, foods, pharmaceuticals, pigments, synthetic yarns, varnishes, etc. — Surface Combustion Div. of Midland-Ross Corp.

123 Low Temperature Refrigeration

Bulletins 95 and 105 describing Niagara "No-Frost" method of refrigeration for producing and holding temperatures of 0 F and below, giving completely automatic operation and continuous operation without shutdown for defrosting. Applications are industrial uses such as subzero testing, production of dry atmospheres and food freezing and storage. — Niagara Blower Co.

124 Process Equipment

Special metal fabrications used in process equipment, scrubbers, high pressure towers, jacketed vessels, surge drums, condensers, high pressure equipment are described in catalog 100-A. ASME code and various materials utilized in storage tanks are described. — Ellicott Fabricators, Inc.

Dust & Fume Collection

125 Draft Inducers

Quickdraft power draft inducers increase combustion efficiency and economy of any heating plant or incinerator; eliminate pulsating, sooting, smoking and need for tall stacks. Bulletin 104 illustrates unique design and operating principle, typical installations and provides specifications for five sizes. Units are available in diameters from 4½ to 30 in. — Quickdraft Corp.

126 Dust Collectors

American-Standard series 342 and 345 dust collectors are two members of the tubular collector family that provide a choice of tube design and wide range of performance. Can be furnished to give compact unit and fit into available space, whether for power or processing applications. Described in bulletins 1828 and 1928. — American-Standard Industrial Div.

127 Dust and Fume Control

Catalog 271 describes AAF's complete line of dust control equipment. Cut-away illustrations are used to describe the four basic types of collectors offered by the company. These four types are dry collectors, wet collectors, fabric arresters and electronic precipitators. Typical installations are also shown for each product. — American Air Filter Co. Inc.

128 Industrial Fans

Bulletin EX-531 covers industrial type EX fans for corrosive, abrasive or hazardous service conditions by the use of coatings, linings, special metals or special construction. These fans are available with usual accessories such as flanged connections, drains, access doors and others. — Bayley Blower Co.

129 Industrial Vent Pipe

Sixteen pages of engineering data (DS-366) on Johns-Manville "Transite" asbestos-cement pipe for ducts, vents and stacks handling industrial waste gases, fumes, dusts, vapors. Gives sizes, weights, dimensions of pipe, couplings and line of fittings including elbows, tees, wyes, etc. Job photographs and venting system diagrams included. — Johns-Manville Sales Corp.

130 Steel Plate Exhausters

Bulletin 600 covers type RD steel plate fans for dust and material handling, available in 14 sizes, with capacities ranging to 15 in. static pressure. — Barry Blower Co.

A wealth of information and data available to consulting engineers, contractors, and engineers with plants and big buildings is represented by the over 600 catalogs, bulletins and manuals described in this supplement to Heating, Piping & Air Conditioning. Use the reply cards on pages 2-29 and 2-31 to request your copies.

Fans, Blowers, Ventilators

131 Air Moving Devices

Air moving devices are covered in catalog. — Greenheck Fan & Ventilator Corp.

132 Axial Fans

Full description, performance tables, dimensions and engineering data for various styles of direct or V-belt drive axial "Airfoil" fans. — Chicago Blower Corp.

133 Axial Flow Duct Fans

An excellent general purpose fan for a wide variety of industrial and commercial uses. All Bowman propellers used on duct fans are non-overloading. From 0 in. static pressure to complete shut-off, their power requirements will not vary more than 10 percent. — Bowman Steel Corp.

134 Belted Ventilating Sets

Bulletin 410 covers BVB belted ventilating sets of the utility type, of non-overloading design, available in 12 sizes, with all accessories. — Barry Blower Co.

135 Blowers

Bulletin describes Century blowers with AMCA certified ratings, backwardly inclined blades of non-overloading power characteristics. Made in utility type with weather hood. Class 1 and 2 construction. Electronically balanced after assembly. Made in all standard code arrangements. — Century Fan & Ventilator Co., Inc.

136 Blowers

Non-overloading class 1 and 2 "Power Fixed" blowers, 12 in. through 89 in., single width and double width, are described in catalog 260. — Peerless Electric Div., H. K. Porter Co., Inc.

137 Blowers

Forward curve class 1 and 2 squirrel cage blowers, 12 in. through 86 in., single width and double width, are described in catalog 270. — Peerless Electric Div., H. K. Porter Co., Inc.

138 Central Air Conditioning

Engineering catalog with illustrative and descriptive information and complete selection data on central plant conditioners, multizone conditioners, sprayed coil units, heating-ventilating units, cooling and heating coils. This catalog is notebook type and is index tabbed for easy and quick use. — Thermal Engineering Corp.

139 Centrifugal Fans

Bulletin 400 describes general styles and types of BBC non-overloading centrifugal fans, SWSI and DWDI in all arrangements. — Barry Blower Co.

140 Centrifugal Fans

Full description, performance tables, dimensions and engineering data for the new "Airfoil" fans. — Chicago Blower Corp.

141 Centrifugal Power Roof Exhausters

Bulletin 60-CK describes new series of "Keyline" spun aluminum, belt-drive centrifugal exhausters for heavy duty service. Low contour with motor and drive assembly mounted to side out of air stream. Automatic belt tightening device. Non-overloading centrifugal wheel. Five sizes, 141 models, with capacity range 725 to 22,400 cfm. — Jenn-Air Products Co., Inc.

142 Centrifugal Roof Exhaust Fans

Roof exhaust fans with low silhouette to conform to modern architectural trends. Fan heights substantially less than conventional designs. Welded construction, quiet operation, minimum maintenance, are features of this roof exhaust fan line. — Davidson Fan Co.

143 Direct Fired Heaters

Four page bulletin 810R on direct fired heaters — "Therma-Flo" suspended series TF for oil or gas firing, hi-boy and counter-flo U series for oil or gas firing, and heavy duty "Therma-Flo" duct heaters in oil fired and gas fired series. Features of each are described, and ratings and dimensions are tabulated. — National Heater Co.

144 Draft Inducers

Quickdraft power draft inducers increase combustion efficiency, economy of any heating plant or incinerator; eliminate pulsating, sooting, smoking, need for tall stacks. Bulletin 104 illustrates unique design and operating principle, typical installations and provides specifications for five popular sizes. Units are available in diameters from 4½ to 30 in. — Quickdraft Corp.

145 Fan Sets

A new line of "Ready Units" — V-belt driven, ready-to-run fan sets — is covered in 36 page catalog 517. These units are for volumes to 25,000 cfm, for static pressures through 2½ in., and for clean air up to 300 F. Dimensions and capacity tables included. — Clarage Fan Co.

146 Fans

Four page folder describing complete line of "Aeromaster" fans for use in industrial cooling installations. — Koppers Co. Inc.

147 Fans and Blowers

Campbell fans and blowers are described in bulletin 382. — Campbell Heating Co.

148 Fire or Explosion Emergency Relief Unit

"Pyrojector" emergency relief unit opens automatically in case of fire or explosion releasing heat, smoke and explosive blasts through roof instead of spreading them outward, thus minimizes damage. Fusible link trigger mechanism. Free illustrated folder gives full information, engineering data and diagrams. — Swartwout Fabricators, Inc.

149 Fire Prevention

Brochure titled "Some Aspects of Fire Prevention in Industrial Buildings," by M. J. Reaney explains the primary cause of spreading of a disastrous industrial plant fire. Demonstrates why fires must be vented to prevent them from spreading horizontally. — Colt Ventilation of America, Inc.

150 Gravity and Power Ventilators

Complete 54 page catalog and engineering data 60-1 on Breidert "Air-X-Hauster" and "Power-X-Hauster" gravity and power ventilators. Includes new square, rectangular, low silhouette models with translucent top available, making combination ventilator and skylight; specifications; capacity tables; test data; installation hints; wind velocity tables for U.S.; selection charts; and other data. — The G. C. Breidert Co.

151 Gravity Roof Ventilators

Engineering data for quick, easy selection of square and rectangular size gravity roof ventilators is outlined in bulletin AEG-60. Charts from 500 to 40,000 cfm and static pressure losses for discharge or relief units are diagrammed. Intakes from 1500 to 35,000 cfm are included along with drawings and dimensions. — Penn Ventilator Co., Inc.

152 Heavy-Duty Fans

Type AF heavy-duty "Dynafoil" fans, featuring a perfected airfoil blade design, are described in catalog 859. This equipment is especially suited to conduit type air conditioning, mechanical draft, industrial processes, tunnel ventilation, and similar applications. — Clarage Fan Co.

153 Induced Draft Fans

Bulletin L-3 covers complete line of centrifugal induced draft fans. Included are rating tables shown at 600 F, dimension data, construction material specifications, recommended sizes of fans for oil, gas, or coal fired boilers. Typical installations are also shown. — Lehigh Fan & Blower Div., Fuller Co.

154 Industrial Fans

Bulletin L-5 gives fundamental data on capacities and construction of the Lehigh type I.E. line of industrial fans. The 28 page, two color bulletin includes complete rating tables and correction ratios for deviations from standard atmospheric conditions. Performance curves, fan laws, and ducting practice are also described and illustrated. — Lehigh Fan & Blower Div., Fuller Co.

155 Louver Ventilators

Especially designed for commercial and light industrial use, Bowman "Louvair" ventilators show a decorative exterior skillfully joined with a structural internal framework and linked with an efficient mechanical design. This combination spells low weight, low initial cost and low maintenance costs. — Bowman Steel Corp.

156 Low Silhouette Roof Ventilators

The Carnes Corp. announces catalog 659, which contains descriptions and engineering data on the new low silhouette power roof ventilators. All models LS with wheel diameters of 12 in. and over carry the seal of approval from the Air Moving and Conditioning Association. (AMCA does not rate sizes below 12 in.) — Carnes Corp.

Air handling equipment to meet the air conditioning, ventilation, exhaust, make-up and other needs of industrial plants and commercial, institutional and public buildings must of course be available in a wide variety of types and sizes, and with features making the equipment applicable to the solution of numerous problems. Here are summarized over 40 publications giving detailed data on these important products.

An engineer or contractor obviously can't find *all* the information he needs in catalogs, bulletins and manuals — but he can find a great deal of the information that he must have. Manufacturers of the hundreds and hundreds of products used in heating, piping and air conditioning offer you a wealth of useful data.

157 Low Silhouette Roof Ventilators

Gravity and power low silhouette roof ventilators for institutions, business and industry are described. Gravity types include rotary, stationary, directional, ridge, unit, and accessories. Power units include booster, curb-mounted, and axial roof ventilators. The latter are offered in horizontal air discharge or vertical air discharge. — Western Engineering & Mfg. Co.

158 Mechanical Draft Fans

Full description and dimensions of a new "Airfoil" forced draft and induced draft fan for large or small boilers. — Chicago Blower Corp.

159 Natural Gravity Ventilators

Bulletin 59 describes the new Colt S.R. series of low silhouette natural gravity type ventilators, their performance and lower, non-obtrusive appearance on roof. Information includes engineering data, dimensions, specifications, tables, air changes and advantages of the Colt S.R. ventilators. — Colt Ventilation of America, Inc.

160 Natural Ventilation

Sixty page catalog describes in complete detail the Colt system of natural ventilation which provides maximum air movement within a building without wires, motors or maintenance costs. Includes nomographs for calculating number of ventilators needed, specifications, charts and photographs of Colt installations throughout the world. — Colt Ventilation of America, Inc.

161 Power Exhausters

Twelve page bulletin 58-B with information on wide range of spun aluminum models in Jenn-Air "Quiet-tested" proven exhauster line: Belt drive and direct drive roof exhausters with centrifugal or axial impellers; direct drive wall exhausters with centrifugal wheels; relief vents. Performance and dimensional data, electrical characteristics, curb cap mounting diagrams. — Jenn-Air Products Co., Inc.

162 Power Ventilators

Bowman standard power ventilator combines the advantages of the gravity ventilator with the positive effect of power ventilation by the addition of a fan and motor. Ventilator constructed of heavy gauge materials, available in "Steelbestos" protected metal, galvanized steel, aluminum and stainless steel. — Bowman Steel Corp.

163 Power Ventilators

Vertical discharge high velocity "Aeromatic" exhauster power ventilator for rapid exhaust is described in bulletin. — Octagon Ventilator Co.

164 Propeller Fans

Complete line of direct-driven and belt-driven propeller fans for commercial and industrial applications are described in bulletin. Available with automatic or motorized louvers. Ten basic sizes give performance range from 610 cfm to 33,900 cfm. — The New York Blower Co.

165 Propeller Fans

Propeller fans, direct drive and belt drive, are described in catalog 280. — Peerless Electric Div., H. K. Porter Co., Inc.

166 Roof Fan

Bulletin covers Century "Cyclone" roof fan, with AMCA certified ratings, of new and improved design and rugged construction. Features include low height, pleasing design, electronically balanced high efficiency B.I. centrifugal wheel with non-overloading power characteristics. Sizes, 10 to 72 in. diameter. — Century Fan & Ventilator Co., Inc.

167 Roof Fans

Bulletin on Century "SpunAir" roof fan, centrifugal fan with spun aluminum housing. Low contour design to meet modern architectural requirements. High efficiency venturi inlet. Electronically balanced non-overloading centrifugal wheel, quiet operation. — Century Fan & Ventilator Co., Inc.

168 Roof Ventilators

The ideal package unit for space-saving roof mounting is described in bulletin. Direct-driven units with centrifugal wheels for performance up to 7400 cfm at 2 in. static pressure. Direct and belt-driven propeller units for performance from 860 cfm to 33,900 cfm at static pressures up to ½ in. — The New York Blower Co.

169 Roof Ventilators

Modern spun aluminum "Vent-X-It" roof ventilators are described in bulletin. — Octagon Ventilator Co.

170 Roof and Wall Exhausters

Bulletin 100-60 covers line of spun power and gravity roof and side wall exhausters under the trademark "AirXpeler," and "AirMpeler" line of belt-driven units, "HiBoy" and "LoBoy" units of backward curve centrifugal design, along with fabricated gravity ventilators. — Ammerman Co., Inc.

171 Room Air Cleaners

Fram room air cleaners, a new concept in room air cleanliness. Full power air circulating device incorporating triple filtration to reduce background contamination such as dust, dirt, pollen. Bactericidal filters kill 99+ percent of germs trapped in filter. — Fram Aire Corp.

172 Translucent Gravity Ventilators

Bulletin LTX-59, a supplement sheet to bulletin LX-59C, provides detailed information for low silhouette gravity exhausters with translucent fiber glass dampers and weather caps. Light values of illumination are presented in table form for easy selection of standard size units. Drawings, unit dimensions and gauges and weights are included. — Penn Ventilator Co., Inc.

173 Ventilating Sets

Packaged air-handling compact units complete with self-contained drives are described in bulletin VS-52-1. These Bayley ventilating sets are the choice for convenience and efficiency in small or medium capacity ventilating or conditioning applications. Attractive design makes these sets suitable for use in exposed locations indoors and out. — Bayley Blower Co.

174 Ventilator and Skylight

Ventilating and skylighting can now be done by a single unit with new Swartwout "Lite-'n-Aire Heat Valve." Unit is high efficiency gravity ventilator with translucent fiber glass components which transmit glareless natural light. Folder gives description, air and light capacities, engineering data and diagrams. — Swartwout Fabricators, Inc.

175 Ventilators

Gravity, power and continuous roof ventilators are described in catalog. — Octagon Ventilator Co.

176 Ventilators

Bonded fiber glass housings make new "Fiber-Aire" ventilators virtually indestructible, silent and resistant to chemical action. Direct and belt drive, 180 to 13,500 cfm. Molded-in, sky-blue color "disappears" against sky. Shock-eliminating air flow guides. Free illustrated folder gives full information, engineering data and diagrams. — Swartwout Fabricators, Inc.

177 Ventilators

Brochure discusses positive ventilation regardless of wind direction. The Triangle "Aero-Foil" is ideally suited to use as a flue cap due to no-downdraft design. Available in aluminum, stainless steel, and copper in addition to standard galvanized. — Triangle Engineering Co.

Fuel Burning, Stacks & Vents, Draft

178 Automatic Rotary Burners

These fully automatic Johnson burners are built with metering pump, three-way magnetic oil valve and suction pump to provide sure, smooth automatic starts even after lengthy shutdown. Available in models for firing on oil only, gas only, or combination-oil-and-gas. Nine sizes, 28 to 560 hp. — S. T. Johnson Co.

179 Coal Heats and Cools Shopping Center

An illustrated case history of modern coal use, describing how Hillside Center, Hillside, Ill., one of the country's largest and most modern shopping centers, uses bituminous coal exclusively for heating and cooling its 73 stores. The economies of coal, boiler plant drawings, and equipment used are highlights of this pamphlet. — Bituminous Coal Institute, National Coal Association

180 Combination Oil and Gas Burners

These Johnson burners enable use of either fuel as price and convenience dictate. A flick of the switch makes the complete change-over from one fuel to the other. This switch can be controlled either manually or automatically. Produces real fuel economies. The equipment is available in nine sizes for every heavy-duty need. — S. T. Johnson Co.

181 Control of Draft

Specifications and information for architects, engineers and contractors covering industrial heating and processing equipment applications are given in 12 page bulletin. — Field Control Div., Conco Engineering Works, Inc.

182 Draft Control Products

Bulletin describes barometric draft regulators for domestic and industrial installations. Gives specifications, size selection and catalog listings for various classes of equipment. Style and model selections offer quality and price lines for all classes of equipment. Sizes available range from 3 to 36 in. pipe diameter. — Walker Mfg. & Sales Corp.

This classification of "Fuel Burning, Stacks & Vents, Draft" includes equipment that prepares fuel for combustion, that burns the fuel, and that removes the products of combustion. Products for coal, oil and gas are covered, as well as combination fuels.

For other classifications of products, see the index on the front cover of this supplement, which is Part 2 of the June 1960 issue of Heating, Piping & Air Conditioning.

183 Draft Control Products

Bulletin describes draft inducers for flue pipe installation for all types of fuels. Specifications, size selection and capacities with catalog listings of models to suit all classes of combustion equipment. Offers moderate priced equipment to help overcome chimney defects and problems arising from lack of natural draft. — Walker Mfg. & Sales Corp.

184 Draft Inducers

Quickdraft power draft inducers increase combustion efficiency and economy of any heating plant or incinerator; eliminate pulsating, sooting, smoking and need for tall stacks. Bulletin 104 illustrates unique design and operating principle, typical installations and provides specifications for five popular sizes. Units available in diameters from 4½ to 30 in. — Quickdraft Corp.

185 Draft Inducers

Bulletin I-59 describes draft inducers for heating boilers and power plants, ranging from small domestic and commercial heating units to those for boilers up to 120,000 lb per hr. Packaged design units are factory assembled, with air-cooled fan bearings and interchangeable inlet panels. Motor, turbine, or dual drive. — L. J. Wing Mfg. Co. Div. of Aero Supply Mfg. Co. Inc.

186 Factory-Built All-Fuel Chimney

Eight page, two color, illustrated bulletin RS-1 gives complete application, installation, and specification information on the durable, attractive, tile-lined Flintkote/Van-Packer factory-built residential chimney. Included are photographs, drawings, and charts together with complete product application data for new construction and for remodeling existing construction. — Van-Packer Div. of The Flintkote Co.

187 Forced Draft Burners

Forced draft "Package" burners provide smooth, efficient operation regardless of stack conditions, firebox pressures. Come completely assembled, wired, tested, ready to install. Powered by Johnson 53 burners in sizes 28 to 560 hp. Models for oil, gas, or combination oil and gas firing. Produce maximum efficiency at minimum fuel cost. — S. T. Johnson Co.

188 Fuel Oil Pump and Heater Sets

Eagan fuel oil pump and heater sets for preparation of heavy industrial fuel oils for proper combustion are described in bulletin. — Walter H. Eagan Co., Inc.

189 Hopper and Bin Feed Stokers

Six page bulletin with complete illustrations and descriptions of Will-Burt industrial, commercial, and domestic stokers — 56 models with capacities 150 through 750 lb per hr. Includes installation drawings and specification tables. — Will-Burt Co.

190 Logic of Stoker Heating

Twelve page brochure illustrates and discusses stoker-fed coal heating in schools, public buildings, and institutional buildings. Contains comparative cost data, reporting heating costs with competitive fuels in actual, large metropolitan school district. — Will-Burt Co.

191 Metal Gas Vent

Sixteen page, two color, illustrated bulletin MGS-34 gives complete application, installation, and specification information on the versatile, strong, and efficient Flintkote/Van-Packer metal gas vent. Photographs, drawings and diagrams aid in product selection and specification. Ordering information is included together with a handy product selection table. — Van-Packer Div. of The Flintkote Co.

192 Oil Burners

Type C-45 oil burner for No. 4 or No. 5 fuel oil, pressure atomizing type, is described in bulletin 100. Models for natural draft or pressurized boilers. Capacity range 10 to 30 gph. Features are simplicity, good combustion, quiet operation, reliability and ease of maintenance. — National Airoil Burner Co.

193 Oil and Gas Burners

New 16 page catalog gives specifications for commercial and industrial gas, oil and combination burners. Covers fully automatic, semi-automatic and manually controlled horizontal rotary burners, gas burners and combination burners; commercial and domestic pressure atomizing types for oil, gas or combination gas-oil; inshot gas burners, forced draft packaged burners. — Ray Burner Co.

194 Oil Leak Detection System

A new eight page catalog 80-1 on the "Paraprobe" oil leak detection system for steam type fuel oil heaters has just been released. The system includes a receiving tank, an exploratory probe, and a high sensitivity alarm relay. Any oil entrained in the condensate triggers the alarm circuit, putting the plant personnel on notice. — Davis Engineering Div., Tube Reducing Corp.

195 Package Boilers

The Ames general catalog AA lists their complete line of package boilers for either steam or hot water production. They are available for either light or heavy oil firing, gas firing, or combinations of the two. Capacities include a range to meet most every commercial and industrial hot water or steam requirement. — Ames Iron Works, Inc.

196 Packaged Firing Units

Packaged firing units for oil or gas and oil, steam atomizing type, in capacities of 60 to 250 gph in standard units and to 500 gph in special units are described in bulletin 28. These are fully automatic units featuring latest type electronic controls for safety; clean combustion over a wide operating range; quiet, reliable and efficient operation. — National Airoil Burner Co.

197 Power Gas Conversion Burners

Catalog includes specifications, installation instructions, and service manual covering "Lo-Blast" power type gas burners for the larger commercial and industrial boilers and furnaces. Capacities available from 700,000 to 20,000,000 Btu per hr. Available for all types of gases and dual fuel, LP and natural gas combination. — Mid-Continent Metal Products Co.

198 Power Gas Conversion Burners

Catalog includes specifications, installation instructions, service manual and parts list covering residential and small commercial type "Economite" gas burners having capacity range up to 700,000 Btu input. Available for all types of gases and dual fuel, LP and natural gas combination. — Mid-Continent Metal Products Co.

199 Scotch Marine Boiler

All wet back, patented, "Atlas" Scotch marine three pass package unit, firing gas, oil or combination gas and oil, is described, in bulletin B-3456. — Titusville Iron Works Co.

200 Self-Clearing Coal Conveyor

Four page bulletin illustrates and describes new Will-Burt power-reversing coal conveyor. Drawings included show typical installations with single or dual discharge, horizontal cross feed tandem, and vertical operation. — Will-Burt Co.

201 Sizing of Boilers and Stokers

Prepared as a special aid for designers of heating plants, this 12 page booklet describes recommended methods of sizing boilers and stokers for heating and process steam loads. Information includes five tables to simplify calculations and selection of equipment. — Bituminous Coal Institute, National Coal Association

202 Smokestacks

Eight page bulletin IS-49 on factory-built, low-cost, insulated refractory smokestack offered by Flintkote's Van-Packer Div. for commercial and industrial application to incinerators, boilers, furnaces. Product information, application data, photographs, drawings, engineering and mechanical data. Typical specifications included for UL-listed model HT smokestack, and for models AP and BF. — Van-Packer Div. of The Flintkote Co.

203 Stokers

Bulletin describes and illustrates Detroit underfeed and overthrow spreader stokers for all industrial, institutional and heating plant installations. Wide range of sizes and capacities, the result of 60 years of leadership in the design, manufacture and installation of stokers. — Detroit Stoker Co., Div. of United Industrial Corp.

204 Underfeed Stoker Applications

Guide specifications for underfeed stoker applications to boilers best suited to commercial and industrial heating plants (750,000 to 6,000,000 Btu per hr) with drawings of flexible layouts of efficient, economical equipment. Specification criteria cover coal and ash handling, boilers, stokers. — Bituminous Coal Institute, National Coal Association

205 Underfeed Stokers

Descriptive literature, line drawings, specifications and prices of "Combustioneer" underfeed stokers from 20 through 1000 lb per hr capacity in both hopper and bin feed models. Also covers "Combustioneer" hopper loaders. — Bituminous Coal Equipment, Inc.

Gaskets & Packing

206 Asbestos Sheet and Gaskets

Eight page catalog describing a single-formula material that can be used wherever asbestos sheet gaskets are applicable. Lists over 120 different chemicals with which it can be used with proved safety. Includes table of sheet sizes carried in stock, gives prices and dimensions of cut gaskets in various types and sizes. — Durabla Mfg. Co.

207 Miscellaneous Rubber Products

Bulletin describes and illustrates Goodall lip, asbestos, piston, flax, plastic and sheet packings; pump diaphragms; pump valves; gaskets and rings; rubber and synthetic tubing; floor matting, etc. — Goodall Rubber Co.

Hot Water & Steam Equipment

208 Automatic Boilers

A six page booklet BE-300 is illustrated with photographs of the Continental automatic boilers' typical combination, gas/oil burner. Enlarged views of both front and fireside areas of the burner with each part and function of the burner indicated make this booklet a most desirable source of information. — Continental Boiler Div. of Boiler Engineering & Supply Co., Inc.

209 Automatic Boilers

A compact four page bulletin BE-400 contains tabulated data on 35 models of Continental automatic boilers. Illustrated design specifications of boilers 15 to 600 hp, along with data on the integral burner system for oil, gas or combination fuels, make the bulletin a useful reference. — Continental Boiler Div. of Boiler Engineering & Supply Co., Inc.

210 Automatic Regulating Valves

Bulletin 954 describes automatic regulating valves for controlling the flow, pressure or temperature of hot water and steam in pipes or related items. — Klipfel Valves, Inc.

211 Boilers

Importance of design standards in influencing efficiency, length of boiler usefulness and operating safety discussed. Low pressure air atomizing burner. Catalog AD 178 explains how factory tests and starting service influence performance. Covers CB line of low and high pressure packaged boilers, 15-600 hp, oil, gas and combination fired models. — Cleaver-Brooks Co.

212 Boilers

Roberts-Gordon catalog gives details on extensive line of oil and gas fired cast iron boilers, oil and gas fired furnaces, central air conditioning units, gas fired conversion and industrial gas burners and gas fired unit heaters. Sizes and designs for domestic, institutional, commercial and industrial applications. — Roberts-Gordon Appliance Corp.

213 Boilers for Oil and Gas

Eight page bulletin on new "Big Mills 640" cast iron water tube boiler for oil and gas firing for use in institutional, commercial and industrial buildings. Of independent header type sectional design. Features are described and illustrated, and ratings, dimensions, and selection data are given. — The H. B. Smith Co., Inc.

FOR YOUR CONVENIENCE

Use the handy postage-paid reply cards on pages 2-29 and 2-31 to request your copies of the trade literature reviewed here.

214 Commercial and Industrial Heat Exchangers

Bulletin lists complete line of Taco instantaneous water heaters and converters. Ratings are given for many operating conditions and applications. Sizes cover a range from 3 to 20 in. in diameter with water heating capacities to 59,000 gph. All units constructed to ASME code and head flanges meet ASA standards. — Taco Heaters, Inc.

215 Convertors

Standard shell and tube type convertors are described in catalog 200A. Dimension charts and capacity data for steam pressures 0 through 15 psig are given. Piping for typical installations is shown. — Ellicott Fabricators, Inc.

216 Convertors

A new 12 page catalog 50-1 on complete line of "Paracoil" U-tube type steam-to-water convertors. Tables are arranged for determination of the convertor size, giving capacities and pressure drops under five operating steam pressures and five water temperature rises. Radiant heating applications listed in separate tables. — Davis Engineering Div., Tube Reducing Corp.

217 Convertors

Bulletin 62, 16 pages, includes convertor rating tables that are accurate and arranged for rapid and easy reading. At least three type R U-tube convertor sizes are listed for each set of operating conditions, depending on pressure drop limitations. Booklet is indexed for quick reference. — The Whitlock Mfg. Co.

218 Desuperheaters

Bulletin 150 explains the advantages of using low pressure, low temperature equipment in high pressure steam generating plants, and describes the evaporative type desuperheater now available as a packaged system. Operating characteristics are given for desuperheaters ranging from 8000 to 150,000 lb per hr steam input. — The Whitlock Mfg. Co.

219 Engineer's Manual on Steam-Water Service

A 44 page catalog describing various ways to control hot water storage tanks, instantaneous heaters, fuel oil preheaters, two-temperature hot water systems, jacket water coolers, domestic hot water systems, etc. — The Powers Regulator Co.

220 Flexible Connectors for Heating Systems

Bulletin FP-5 describes "Anaconda Flexpipe" connectors, in sizes ¼ through 2 in., for absorbing line vibration, taking up piping travel and connecting outlets which do not line up in wet heating systems. Construction details, specifications, typical installations and advantages of using these connectors are shown. — Anaconda Metal Hose Div., The American Brass Co.

221 Gas Boilers

Six page descriptive folder covers Burnham "Holiday" 61 series gas boilers for residential and other small buildings, and "Holiday" 70 series for application to large home, commercial and institutional installations. — Burnham Corp., Heating and Cooling Div.

222 Gas Fired Water Heating

Guide (entitled "Enough Hot Water . . . Hot Enough") to sizing, selection, installation of gas fired water heating systems for restaurants and cafeterias. Discusses need for ample quantities of 180 and 140 F water; types of dishwashing equipment described, including arrangements and sizes of water heating apparatus. Information on water and gas piping, venting, clearances. — Industrial and Commercial Gas Section, American Gas Association.

223 Heating Boilers

Heating boiler line is described in bulletin 78. — Raypak Co., Inc.

224 Heating Specialties

Catalog 76-H shows complete line of valves, traps and vents, and includes capacity charts and roughing-in dimensions. — Marsh Instrument Co., Div. of Colorado Oil and Gas Corp.

225 Heating Specialties

Twelve page catalog lists principal Sarco products (steam traps, temperature controls, heating specialities, strainers, etc.) with illustrations, descriptions, and technical data. — Sarco Co., Inc. and Sarcotherm Controls, Inc.

226 Heating Specialties and Water Heaters

Catalog J-99 describes and lists Taco's line of circulators, "Flocheks," "Air-Scoops," air valves, tempering valves, venturi fittings, relief and reducing valves, "Taco-Matic" valves, "Paneltrols," storage and tankless heaters for residences and small commercial and industrial buildings. Also included is a table giving average service water requirements for various types of buildings. — Taco Heaters, Inc.

WHEN USING REPLY CARDS

When you use the reply cards on pages 2-29 and 2-31 to request the literature you want, please circle clearly the corresponding item number on the card for each catalog or bulletin to be sent to you.

The item number is the big number at the left of the title for each item. For example, in the item immediately below, the number to circle on the reply card would be 227.

In filling out the card, it will be appreciated if you will print or type your name, address, etc. clearly to simplify the task of sending you the material you want.

227 High Temperature Water Generators

Advantages of "International-LaMont" high temperature water generators are described in new 16 page bulletin 1600. Engineering data section gives factual comparison between HTW and high pressure steam systems along with pertinent cost considerations. Typical pressurization and pumping arrangements are discussed and illustrated. — The International Boiler Works Co.

228 Hot Water Heating Boiler

"Multi-Temp" hot water heating boiler, which represents a new concept in the use of gas for commercial and industrial installations, is described in bulletin. Sixteen sizes with a capacity range from 300,000 to 3,600,000 Btu per hr input. Provides "true" input modulation by employing a multiple of Hydrotherm units each equipped with its own set of controls. — Hydrotherm, Inc.

229 Hot Water Heating Boilers

Bulletin describes Hydrotherm hot water heating boiler of all cast iron construction, 11 sizes with a capacity range from 50,000 to 300,000 Btu per hr. A quality product, especially engineered for gas fired systems. Requires minimum installation space;is efficient in operation; and is competitively priced. — Hydrotherm, Inc.

230 Hot Water and Steam Boilers

Three series of hot water and steam boilers ranging from 40,800 to 3,420,000 Btu per hr are described in attractive four color publication "The Quality Tells" (form WS 117 P). — Janitrol Heating & Air Conditioning, A Div. of Midland-Ross Corp.

231 How to Select a Boiler

Explains importance of first cost vs. operating costs, selection of fuels, how efficiency offsets initial costs, safety controls, headroom requirements of boiler rooms, forced draft vs. induced draft, updraft construction and gas travel in effecting heat transfer. This 20 page pocket size book is profusely illustrated. — Cleaver-Brooks Co.

232 Hydronic Heating

The American-Standard hydronic heating ratings, data, and dimensions catalog provides engineers and installers with information on equipment for residential and commercial application — gas and oil fired cast iron boilers; gas and oil fired conversion burners; nonferrous and cast iron baseboard heating panels and wall-mounted convectors; cast iron radiators. — American Radiator and Standard Sanitary Corp., Plumbing and Heating Div.

233 Overhead Valve Operators

Bulletin shows the 10 sizes of Babbitt adjustable sprocket rims and guides for operating overhead valves from the floor, as well as the range of valve handwheel diameters they will fit. Also shown are the list prices of the rims and guides as well as the chain which fits them. — Babbitt Steam Specialty Co.

234 Package Boilers

The Ames general catalog AA lists their complete line of package boilers for either steam or hot water production. They are available for either light or heavy oil firing, gas firing, or combinations of the two. Capacities include a range to meet most every commercial and industrial hot water or steam requirement. — Ames Iron Works, Inc.

235 Package Hot Water Boilers

Package boiler economy for modern hot water systems is the subject of a six page bulletin entitled "For the First Time." Features described and illustrated, and general specifications, dimensions, capacities and other data included. — Cyclotherm Div. of Crane Co.

236 Package Hot Water Systems

Package volume hot water systems are described in bulletin 105. — Raypak Co., Inc.

237 Package Steam and Hot Water Generators

Package steam and hot water generators are described in bulletin entitled "More From Less." Features are carefully described and illustrated. Steam generators available in sizes 15 to 750 hp. Hot water generators available from 670,000 to 6,700,000 Btu output for both low and high temperature hot water. — Cyclotherm Div. of Crane Co.

238 Packaged Boilers

Twelve page catalog describes type AS Superior packaged water tube boilers for capacities from 4000 to 21,000 lb per hr of steam. Complete packages with rotary burners, integrated controls, soot blowers, refractory, and insulation, these units also have quiet rear-mounted draft fan which provides air cooling of furnace floor. — Superior Combustion Industries Inc.

Advertisers in Heating, Piping & Air Conditioning have furnished these descriptions of their catalogs, bulletins, and other helpful data. Copies are available to readers on request.

239 Packaged Boilers

"Webco-Ray" automatic three-pass packaged boilers for heating, power and process steam are featured in new catalog. Ratings, data, dimensions and other installation data are given in this comprehensive booklet. Units available for gas, oil or combination gas-oil. Capacities of these packaged units range from 10 to 600 boiler hp. — Western Boiler Co.

240 Packaged Boilers

New series of Webco-Ray "Husky" completely automatic forced draft packaged boilers. Capacity range 10 to 125 hp, 335,000 to 4,180,000 Btu per hr. Units available for light oil, natural gas, combination gas-light oil operation. Complete operating and programming type flame safeguard controls, circuit breakers, standard in enclosed cabinet. — Western Boiler Co.

241 Packaged Coal-Fired Boilers

The full line of "Coal-Pak Automatic" packaged unit boilers for burning low cost bituminous coal are described in 10 page bulletin 1100. Combustion controls as well as automatic coal feed and ash removal systems for rapidly following changing load demands are described. Units are available for low or high pressure service in sizes from 71.6 to 300 hp. — The International Boiler Works Co.

242 Packaged Hot Water Boiler

Type CC Superior packaged boilers designed for hot water operations and for capacities from 670,000 to 11,720,000 Btu per hr are described in this catalog. Burning gas, oil, or both, the type CC is equipped with a newly developed venturi action mixing tube which overcomes the problems developing from improper boiler circulation. — Superior Combustion Industries Inc.

243 Packaged Steam Boiler

Type CC Superior packaged steam boilers for capacities from 20 to 350 bhp are described in this catalog. A completely packaged unit which will burn gas, oil, or both, the type CC combines simple installation with high efficiencies and operating economy. Although designed for limited space conditions, the type CC makes no concession to quality. — Superior Combustion Industries Inc.

244 Packaged Water Tube Boilers

Two complete lines of low and high pressure, forced draft water tube package boilers are described in bulletin 1400. The "Compak" series of fire-tested units for oil and/or gas is offered in 22 sizes ranging from 12 through 750 hp. Engineering specifications are included. — The International Boiler Works Co.

245 Radiation

Condensed catalog containing two pages of information on each model of Shaw-Perkins "Panel-Vector" and "Airadiator" radiation. Descriptions, specifications, dimensions, ratings, etc. are included. Offers full literature on each model. — Shaw-Perkins Mfg. Co.

246 Safety Controls for H.W. Heating Boilers

Engineering information in easy-to-follow form, that tells why safety devices are needed on hot water space heating boilers, which ones to use, and how to select them is given in bulletin P-30C. Liberally illustrated with drawings and diagrams. — McDonnell & Miller, Inc.

247 Safety Controls for Low Pressure Steam Boilers

Bulletin L-711 answers practically all safety control problems encountered in the low pressure steam boiler field. Tells the story in simple diagrams and equally simple explanation. Covers everything from residential through multiple commercial and industrial boiler jobs. — McDonnell & Miller, Inc.

248 Scotch Marine Boiler

All wet back, patented, "Atlas" Scotch marine three pass package unit, firing gas, oil or combination gas and oil, is described in bulletin B-3456. — Titusville Iron Works Co.

249 Scotch-Type Boiler

Six page descriptive folder covers new Scotch-type steel heating boiler with new economical three-pass design. Fully describes ratings, dimensions, etc. — Burnham Corp., Steel Boiler Dept.

250 Selecting Steam Traps and Specialties

Thirty-six page booklet giving sizing information and correct methods of installation also describes and illustrates four types of steam traps and air release valves and pipe line strainers. — The V. D. Anderson Co., Div. of International Basic Economy Corp.

251 Steam Generators

How advanced "Cyclonic" combustion method sends steam costs down is the subject of six page bulletin on steam generators that describes and illustrates features and gives general specifications and standard ratings and dimensions. — Cyclotherm Div. of Crane Co.

252 Steam Heat Transfer Surface

Catalog 956 describes "Grid" cast iron steam heat transfer surface unit heaters, blast heaters, and radiators, and illustrates one-piece construction. Included are air distribution charts, heating capacities, conversion tables, and specifications. This four-section catalog with tab index is well illustrated. — D. J. Murray Mfg. Co.

253 Stokers

Bulletin describes and illustrates Detroit underfeed and overthrow spreader stokers for all industrial, institutional and heating plant installations. Wide range of sizes and capacities, the result of 60 years of leadership in the design, manufacture and installation of stokers. — Detroit Stoker Co., Div. of United Industrial Corp.

254 Storage Heaters

Bulletin 40C, 16 pages, has been written to facilitate selection of type K storage heaters for conditions normally found in buildings of various classifications. Typical layouts are included, along with tables of pressure thickness, vertical and horizontal storage heater dimensions, and capacities. — The Whitlock Mfg. Co.

255 Tanks

Catalog 100 A covers materials, dimensions, and sizing data for hot water storage tanks and generators, air receivers, blow-off tanks and hydropneumatic tanks. Has coil sizing charts and data for hot water generators, and details about linings to stop corrosion, including baked plastic, copper, cement and galvanizing. — Ellicott Fabricators, Inc.

256 Temperature Regulators

Bulletin 560 illustrates and describes type T direct acting and type AT pilot operated self-contained temperature regulator, also combination pressure and temperature regulators, types PTT, PTS and PTM available in either bronze or semi-steel body with stainless steel pilot valve, main valve and seat. — O. C. Keckley Co.

257 Unit Heaters

Wilson unit heaters, available in six models in capacities 60,000 to 717,000 Btu, are described in

To simplify your requests for copies of the trade literature that is reviewed here, use the convenient postage-paid cards on pages 2-29 and 2-31. Heating, Piping & Air Conditioning will advise the manufacturers.

bulletin 60. Unit heater is completely dependable in service where corrosive atmospheres are encountered. Uses directional finned radiation. — Wilson Engineering Corp.

258 Vertical Tank Suction Heater

Four page bulletin 60-JS describes and gives design and size capacity tables on the new "Paracoil" type VUF vertical tank suction heater for installation in underground storage tanks. The heater is suspended from a tank manhole, with all service connections outside the tank. Specially designed to simplify installation and service. — Davis Engineering Div., Tube Reducing Corp.

259 Water Tube Boiler

Line of on-off boilers, called the "Cycle-Modulatic," is described in bulletin 4010. Expensive modulating equipment used on other boilers has been eliminated. Tells how a simple on-off type of boiler may be the economical answer to steam needs. Eight pages, complete specifications. — Vapor Heating Corp.

260 Water Tube Boiler

Bulletin 586-A (12 pages) describes line of fully modulating (4 to 1 turndown) "Modulatic" water tube boilers. Covers compact models in size range from 10 to 160 bhp (334,000 to 5,356,000 Btu per hr.) Explains principle of operation, tells how compactness and reliability are obtained. — Vapor Heating Corp.

261 Water Tube Package

Bulletin B-3255 covers sizes 10,000 to 100,000 lb per hr water tube package units. Shipped completely assembled ready for connection to fuel, steam, water, electricity. — Titusville Iron Works Co.

262 Welding Fittings and Forged Steel Flanges

Forty-eight page bulletin FB 77 is published for piping engineers as a time saving convenience in computing preliminary design requirements of pressure piping systems. Summarizes and correlates various specifications of ASME, the ASA Code for Pressure Piping, and covers design, manufacture and installation of various types of piping systems. — The Babcock & Wilcox Co., Tubular Products Div., Welding Fittings Dept.

263 Zone Heating Valve

Four page brochure describes operation of "Zonvalve" thermostatically controlled zone heating valve. Cutaway views show mechanical features, cartoons illustrate ease of installation and operation. Layouts show typical installations on radiators, convectors and supply lines. Photos of all models and accessories, wiring diagram and dimensions are included. — Heat-Timer Corp.

Humidification, Dehumidification & Evaporative Coolers

264 Air Conditioner

Bulletin 140 on Niagara "Hygrol" air conditioner describes means of precise manipulation of humidity and temperature, air conditioning critical processes of drying, and holding heat-sensitive materials, using absorbent liquid to dry air at moderate temperature without refrigeration. Diagrams, photos, chart of dehumidification, units up to 20,500 cfm. — Niagara Blower Co.

265 Air Conditioning and Drying

New 16 page bulletin K-160, "Dollars Out of the Air," describes latest model (C) "Kathabar" air conditioning and drying systems. The equipment is used to stop condensation; speed drying and other processing operations; obtain subfreezing dewpoints; make air sterile to hospital standards. Also covers the new "Kathabar" climate control prefabricated standard test rooms. — Surface Combustion Div. of Midland-Ross Corp.

266 Air Hygiene for Hospitals

A 20 page report, "Air Hygiene for Hospitals," discusses the problem of hospital infection and the findings of the Research Foundation, University of Toledo, on the removal of airborne bacteria. Included are charts and illustrations explaining the application of "Kathabar" air sterilizing systems for hospitals. — Surface Combustion Div. of Midland-Ross Corp.

267 Air Washers

"Capillary" air washers, basic to many installations where air is required at controlled conditions, described in section 10. Evaporative cooling minimizes refrigeration needs. Humidification, dehumidification, cleaning, scrubbing gases and fumes also functions of these systems. Refrigeration may be incorporated or added later. "Capillary" cell features high saturation efficiency, low resistance. — Air & Refrigeration Corp.

268 Better Air

Catalog 518, entitled "Better Air Is Our Business," describes the complete line of company products with emphasis on air conditioning units, coils, cooling towers, evaporative condensers and packaged liquid chillers. Also described are air filters, This quarterly trade literature supplement to Heating, Piping & Air Conditioning describes catalogs, bulletins, and other data available, without obligation, to readers on request. The descriptions are grouped according to general classifications of subjects or equipment, as indicated on the front cover of this supplement.

Each month, regular editorial departments in Heating, Piping & Air Conditioning are devoted to Equipment Developments and to Recent Trade Literature announced by all manufacturers serving the field of heating, piping, and air conditioning.

Heating, Piping & Air Conditioning is written and edited for consulting engineers; mechanical (heating, piping, and air conditioning) contractors; engineers with industrial plants; and engineers with big buildings.

dust collectors, heating specialties, engine and compressor intake filters and portable heaters for industrial use. — American Air Filter Co. Inc.

269 Central Air Conditioning

Engineering catalog with illustrative and descriptive information and complete selection data on central plant conditioners, multizone conditioners, sprayed coil units, heating-ventilating units, cooling and heating coils. This catalog is notebook type and is index tabbed for easy and quick use. — Thermal Engineering Corp.

270 Duct Type Humidification Equipment

Designed for installation in existing or planned duct circulating systems, the standard Walton duct type humidifiers described in this catalog atomize from 3 to 24 lb per hr of water vapor. The catalog offers full engineering information, plus specific application and usage data. — Walton Laboratories, Inc.

271 Electric Humidifier

Mueller "Climatrol" type 50-800 electric humidifier provides for perfect humidity level by manual or humidistat (optional) control. Unit will evaporate up to 26 quarts of water per day — enough for a modern home of 2000 sq ft. — Mueller Climatrol Div. of Worthington Corp.

272 High Pressure Surface Dehumidifiers

Eight page bulletin DD-1 is devoted to surface dehumidifiers for high pressure air conditioning systems, factory insulated, with and without sprays for the coils. — Buensod-Stacey, Inc.

273 Humidification

Complete data on air-controlled and electrically-controlled unit steam humidifiers for duct or area installations is given in booklet on humidification for profit. Describes problems caused by wintertime dry air and effect on human comfort, as well as on hygroscopic materials. Contains condensed data on humidifier selection, sizing, location, installation. — Armstrong Machine Works.

274 Humidification

Booklet explains how proper humidity in indoor air increases comfort and cuts fuel bills. In words and pictures, describes the Lennox "Humidi-spray," automatic spray type humidifier, designed for addition to a forced air heating system, and how it can add up to 18 gal of moisture per day to dry indoor air. — Lennox Industries Inc.

275 Humidification

Bulletin is designed to assist architects, engineers and contractors in technical aspects of commercial and industrial humidification. Includes estimating the capacity, sizing and selecting equipment. This bulletin also covers the humidification requirements of more than 70 industrial applications. — Walton Laboratories, Inc.

276 Space Type Humidification Equipment

Catalog covers standard space type atomizing humidifiers, together with application and engineering information for ductless installations. Self-contained humidity stations in several sizes generate from 1 to 24 lb per hr of water vapor. — Walton Laboratories, Inc.

277 Spray Type Dehumidifiers

Bulletin 37 gives complete information on Marlo coil type spray dehumidifiers for washing, cleaning, humidifying, dehumidifying, heating and cooling, available in 327 sizes, air volumes from 600 to 76,000 cfm. Bulletin includes design specifications, dimensional data and engineering data. — Marlo Coil Co.

Infra-Red Heat

278 Infra-Red Radiant Heating

"Panelbloc" engineering bulletin PE-159 is pocket size reference bulletin explaining principles of infra-red radiant heating and specifically describes how development of radiant heat energy is generated by overhead gas fired "Panelbloc" heater. Different heat loss calculation methods are described. There are various handy engineering tables included. 16 pages. — The Bettcher Mfg. Corp.

Insulation (& Sun Heat Control)

279 Blowing Agents for Polyurethane Foams

The properties and advantages of using "Freon" blowing agents for polyurethane foams rather than carbon dioxide are discussed. Insulation value, compression strength, resistance to moisture vapor, adhesion to metals, less thermal cracking, better control of density are among the foam properties improved by using "Freon" blowing agents. — E. I. du Pont de Nemours & Co., "Freon" Products Div.

280 Building Insulation

Booklet FB-105, 20 pages, illustrates effectiveness of "Foamglas" as building insulation material through photographs, case studies, and line drawings. Also data on accessories used with "Foamglas"; chart computing "U" value required to prevent warm condensation; and technical data on construction of roofs, curtain and core walls, and wall linings. — Pittsburgh Corning Corp.

281 Cellular Glass Insulation and Insulating Refractory

Booklet FI-106, 12 pages, lists benefits of "Foamglas" insulation, with available shapes, thicknesses. Outlines application procedure as pipe insulation (−450 F to +800 F), with application photos, and lists accessory materials. Also contains information on "Foamsil" acid-resistant insulating refractory, properties of this 99 percent pure fused silica glass. — Pittsburgh Corning Corp.

282 Duct Insulation

Revised catalog ULD describes the use of "Ultralite" long textile type glass fiber insulation for duct wrap and duct liner. Characteristics and application methods, together with available and suggested thicknesses, are listed. Facings available, including new gray fire resistant coating, shipping information and specifications are given. — Gustin-Bacon Mfg. Co.

283 Expanded Polystyrene Insulation

Eight page brochure, which discusses "Uni-Crest," United Cork Companies' expanded polystyrene insulating material, describes the product, lists its physical properties, gives standard dimensions, and recommends thicknesses for a wide range of temperature conditions. Photos and drawings illustrate various uses and the text discusses simplified techniques of installation and finishing. — United Cork Companies.

284 Fiber Glass Duct Insulation

Properties, characteristics and product forms of "Microlite" fiber glass duct insulation are described. Application methods are explained and illustrated. Tables show thermal performance, recommended thicknesses, types of available vapor barriers, fire hazard rating and compliance with federal specifications. Form IN-285A. Six pages, two colors. — Johns-Manville Sales Corp.

285 Fiber Glass Duct Liner

Describes function of dual-density design, acoustical and thermal properties, product characteristics and application methods of "Micro-Bar" fiber glass duct liner. Drawings show construction of integral nosings and shiplap joints. Tables on thermal conductivity, noise reduction and surface friction coefficients, fire hazard rating, sizes, packaging. Form IN-302A. Eight pages. — Johns-Manville Sales Corp.

286 Fiber Glass Pipe Insulation

Construction and application features of "Micro-Lok" fiber glass pipe insulation are explained. A guide to specifications for application and finishing for various types of service is included. Descriptions of available jacket materials, thermal conductivity curve and complete table of sizes also included. Form IN-237A. Eight pages, two colors. — Johns-Manville Sales Corp.

287 Flame Resistant Vapor Barriers

Folder contains descriptive information, technical data and actual samples of "Pyro-Kure," flame resistant vapor barriers for duct and insulation facing and pipe jacketing. Underwriters' Laboratories ratings and physical property summaries are also included. — American Sisalkraft Corp.

288 Insulated Panels

"A&R" factory insulated panels, which are strong, rigid and virtually monolithic, are described in section 50. Fabricated in sizes to suit job requirements with various thicknesses of insulation and of materials suitable for the project use, these panels are quickly erected. Both interior and exterior weatherproof constructions are available. — Air & Refrigeration Corp.

289 Insulation

A comprehensive 44 page technical data booklet describes "Insul-Fil" material and its application. Also featured are engineering drawings, heat loss determination graphs and other information designed to guide the mechanical engineer and the installing contractor to an economical and trouble-free installation. — Insul-Fil Co., Inc., Div. of Miracle Adhesives Corp.

290 Insulation Finish

Bulletin on Armstrong "Armaflex" finish describes this material and its advantages. "Armaflex" finish is a vinyl lacquer type coating for use over "Armaflex 22" pipe covering and "Armaflex" sheet insulation, both indoors and out. — Armstrong Cork Co.

291 Insulation Hangers

"Gemco" products, consisting of a complete line of insulation anchors, self-locking washers, etc., are described in bulletin. Various lengths of "Gemco" (metal) insulation spindles and prong hangers are available; also several types of "Gemco" washers, for securing insulation in place. — Goodloe E. Moore, Inc.

292 Insulation Hangers

"Tuff-Weld" (nylon) insulation hangers have nylon base plate, in which a metal spindle (various lengths are available) can be inserted through a center hole. One hundred percent nylon units are also available, consisting of nylon base plate and spindle molded into one unit, plus nylon self-locking washer. — Goodloe E. Moore, Inc.

293 Insulation for Hot and Cold Piping

Four page folder introducing "Foamglas Stay-Dry" insulation for commercial applications from 35 F to 350 F. Contains photos illustrating product features, application specification, suggested thicknesses, available sizes and thicknesses for iron pipe and copper tubing, along with a list of "Foamglas" physical properties. — Pittsburgh Corning Corp.

294 Insulation Tubing

Properties, test data and specifications applicable to "Cell-Tite" insulation tubing for copper lines are given in eight page bulletin. — B. F. Goodrich Sponge Products.

295 Pipe Insulation

Bulletin on Armstrong "Armaflex 22" describes a flexible, foamed plastic material in pipe covering form widely used on liquid cooling and heating lines, chilled water lines and other cold lines in heating, air conditioning, refrigeration, industrial processing, and plumbing applications. — Armstrong Cork Co.

296 Pipe Insulation

Eight page booklet describes the characteristics and application data for one piece molded "Snap-On" pipe insulation of fine glass fibers. Application specifications cover heating, plumbing, insulation of valves and fittings, cold piping, dual temperature and outdoor piping. Thickness charts, and information about sizes, packaging and available jackets are also included in booklet. — Gustin-Bacon Mfg. Co.

297 Pipe Insulation

Mundet "Superglas" glass fiber pipe insulation, one piece, full length sections which open easily and close automatically with locking "hinged" action. Snug closure insures minimum heat loss or gain. Incombustible; doesn't rot, shrink, swell. Unaffected by moisture or subfreezing conditions. Doesn't break or crumble. Bulletin includes thickness tables and specification guide for this glass fiber pipe insulation. — Mundet Cork Corp., Insulation Div.

298 Reflective Insulation

Twenty-four page booklet explains dynamics of heat transfer, thermal efficiency, and condensation, compares the thermal efficiency of modern insulation materials. This data book on reflective insulation gives information on techniques of home and industrial insulation and provides standard architectural specifications and "open" specifications for all types of insulations. — Reflectal Corp.

299 Sheet Insulation

Bulletin on Armstrong "Armaflex" sheet insulation describes the properties of this flexible, foamed plastic material in sheet form. According to the bulletin, this sheet insulation is particularly adaptable to insulating of large tanks of all shapes, irregular vessels, and oversize piping. — Armstrong Cork Co.

300 Sunscreen

Technical explanation of effective means of controlling solar heat and glare is given. "KoolShade" sunscreen eliminates penalties of glass usage in architecture yet affords highest outward visibility. Operating like miniature venetian blind outside sun-exposed window, "KoolShade" intercepts sun's rays before they reach glass. Design, construction, installation explained and illustrated. — Reflectal Corp.

301 Thermal Conductivity Tester

Apparatus and procedure for measuring the thermal conductivity of insulation materials is discussed in bulletin. The apparatus is designed for use with rigid plastic foams but the procedure can be used for other solid materials. — E. I. du Pont de Nemours & Co., "Freon" Products Div.

302 Thermal Conservation

Booklet "Complete Service for Efficient Thermal Conservation" contains handy charts of Mundet insulating products, with effective temperature ranges and product descriptions. Includes thermal conservation products for heating and air conditioning and low pressure steam. Four pages of useful data. Temperature ranges from minus 250 F to plus 1900 F. — Mundet Cork Corp., Insulation Div.

Motors, Bearings & Drives

303 Ball Bearing Units

Bulletin 758 describes exclusive design and engineering features of "Sealmaster" ball bearing units. The literature has a large exploded illustration with engineering and craftsmanship feature callouts. Bulletin is also highlighted with manufacturing and application photographs. — Sealmaster Bearings, A Div. of Stephens-Adamson Mfg. Co.

304 Bearing Units

Bulletin 359 describes the L, SL, LP, LFT "Sealmaster" L series low cost, precision bearing units. The literature features comprehensive engineering and technical data, specifications, photographs and basic mounting arrangement diagrams. Bulletin also offers suggested applications and uses. — Sealmaster Bearings, A Div. of Stephens-Adamson Mfg. Co.

305 Big Job Rated Motors

Four page bulletin describes the new line of Wagner 250 through 1000 hp electric motors in all new compact enclosures through frame sizes 962S. Major features of the motors are pictorially shown throughout the literature. — Wagner Electric Corp.

306 Dry Fluid Drives

Sure, economical way to start loads smoothly, protect against shock and overload, reduce maintenance costs, described in bulletin A640B on "Flexidyne" dry fluid drives. Centrifugal force wedges steel shot between housing and rotor for 100 percent efficiency at full load speed. Fractional to 100 hp — available from stock. — Dodge Mfg. Corp.

307 Flexible Couplings

Catalog 501 describes "Amerigear" and "American" flexible shaft couplings used in coupling together mechanical power transmission equipment. Includes pertinent specification data such as ratings, dimensions, selection tables and special flexible coupling types. Describes in detail the exclusive "Amerigear" fully-crowned gear tooth form. — Zurn Industries, Inc., Mechanical Power Transmission Div.

308 Flexible Cushion Coupling

The "four-way-flex" of unique "Para-flex" coupling described in bulletin A669C compensates for end float, parallel and angular misalignment, or any combination. Also absorbs torsional vibration, reducing noise and protecting machinery. Rubber tire-like flexing member mounted between semi-steel flanges which fasten to shafts with "Taper-Lock" bushings. No lubrication, maintenance. — Dodge Mfg. Co.

309 Fractional Horsepower Motors

Four page bulletin SB-177 showing construction and design details of single phase and polyphase motors for the heating, ventilating and air conditioning industry in 48 and 56 frame. — Marathon Electric Mfg. Corp.

310 Integral Horsepower Motors

Four page bulletin SB-186 showing construction and design details of integral horsepower motors from frames 364U through 445US. Complete with ratings and dimensions. — Marathon Electric Mfg. Corp.

311 Motor Application Guide

Bulletin 270B is guide to selection of electric motors. Material organized from point of view of user, beginning with machine to be driven and its requirements. Charts show how characteristics of driven machine and motor are matched. Polyphase, single phase and direct current motors described with their operating advantages. Illustrated with examples. — Century Electric Co.

312 Motor Selector

Howell motor selector bulletin L-1661A lists selection and specification data for complete a-c motor line, 1/40th to 300 hp; standards and specials; wide range of voltages, speeds, mountings, enclosures. Also, gearmotors, speed reducers, generators and industrial grinders. — Howell Electric Motors Co.

313 Motors

Catalog AEB 1059 is designed to assist motor users, re-sellers, and specifiers in the preliminary selection of a suitable motor. A wide range of motors is illustrated and a number of mechanical variations are shown. — Fairbanks, Morse & Co.

314 Motors

Condensed catalog EM 159 gives a condensed listing of ratings from 1/3 hp through 200 hp with outline dimensions and construction features. Covers verticals, horizontals, and other modifications and all enclosures. — A. O. Smith Corp.

315 Pillow Blocks

Bulletin 1058 describes exclusive design and engineering features of "Sealmaster" LP pillow block, L series and SL series bearing units. The literature highlights the economy, performance and quality of these low cost, precision units. Bulletin features comprehensive engineering and technical data, specifications and photographs of the new bearing units. — Sealmaster Bearings, A Div. of Stephens-Adamson Mfg. Co.

316 Protected Integral Hp Motors

Four page bulletin SB-180 showing construction and design details of 4-in-1 integral horsepower motor in frame sizes from 182 through 326U. Shows typical performance curve and ratings and dimensions. 4-in-1 protection, splashproof, weather protected, guarded and drip-proof. — Marathon Electric Mfg. Corp.

317 Resilient Mounted Motors

Four page bulletin lists Wagner 1/6 through 10 hp motors available in resilient mountings. Covers the mounting construction and various "whys" and "wherefores" of quiet motor operation. Shows typical application areas and lists three different types of resilient mounted motors available. — Wagner Electric Corp.

318 V-Belt Drive

"R/M Poly-V" drive designed for air conditioning blowers, pumps and compressors. Major causes of V-drive trouble engineered out, length matching problems eliminated, drive life longer, only two cross sections fulfill every requirement. Single, endless V-ribbed belt runs smoothly over grooved sheaves to deliver more power in same space. — Raybestos-Manhattan, Inc., Manhattan Rubber Div.

319 V-Belt Drives

New "Dyna-V" compact V-belt sheaves and belts, capable of handling up to three times as much horsepower in given space described in bulletin A695A. "Taper-Lock" bushings for quick, sure mounting. Available from stock in two groove sizes for capacities up to 200 hp. Drives up to 1500 hp furnished on order. — Dodge Mfg. Corp.

320 V-Belts

Fourteen page catalog 179 on U. S. "Royal" variable speed V-belts with information on standard belt sizes, a changeover guide, and data on engineering assistance and stocks. Construction of the belts is carefully illustrated and described. —Mechanical Goods Div., United States Rubber Co.

321 V-Belts

New "R/M CX" molded V-belt is fully molded, fully jacketed notched V-belt ideally suited for light air conditioning units requiring single belts and where vibration and noise cannot be tolerated. No cut notches, no flexcracking, no separation of belt components, high flexibility for extremely small diameter sheaves, increased drive life. — Raybestos-Manhattan, Manhattan Rubber Div.

322 Vertical Solid Shaft Motors

Four page bulletin lists the features, frame sizes, electrical characteristics and performance data of Wagner vertical solid shaft "P" base motors. Explains how the motors are designed specifically for manufacturers of pumps, mixers, agitators and other products requiring normal thrust vertically mounted motors. — Wagner Electric Corp.

Odor Control, Air Freshening

323 Air Purification

New 12 page bulletin 108A describes, illustrates "Dorex" activated carbon air purification equipment — C cells, H canisters. Data on selection, installation and application. Typical specifications, information about replacement service, lists of representatives and users. Useful discussion of activated carbon, how to achieve conditions generally necessary for proper purification. — Connor Engineering Corp.

324 Charcoal Filters

Bulletin includes a strong system story and revised specifications on Honeywell charcoal filters. Discusses how charcoal removes odors and the economy it can provide in an air conditioning system. — Minneapolis-Honeywell Regulator Co.

325 Dust and Odor Filter Frame

Product data sheet 131 illustrates new Cambridge "Aerosolve"-charcoal filter frame specially designed to simplify installation and servicing of the two types of filters. Available for charcoal filter of user's choice or as complete packaged unit. Shows dimensions, efficiencies and pressure drops. — Cambridge Filter Corp.

With the ever-increasing application of air conditioning and ventilation to industrial, commercial, institutional and public buildings, problems of air purification and odor control demand more and more attention on the part of engineers and contractors concerned with heating, ventilating, and air conditioning services.

Parts, Clamps, Anchors, Bolts, Screws, Etc.

326 Anchors

Four page, two color brochures (Anchor bulletin 3 and "Mira" data sheet 2), describe Miracle surface anchors and how they are used for applying insulation without need for mechanical attachments. — Miranco, Inc., Div. of Miracle Adhesives Corp.

327 Flexible Struts for Structural Bracing

Bulletin 229A describes, illustrates flexible ball-type struts for use as guy rods, braces, and struts to limit wind sway, dampen vibration, protect against seismic shock damage, carry stress loads, allow for thermal expansion. Applicable to tall columns, stacks, and vessels. Also for flexible suspension of piping. Diagrams, load data. — Barco Mfg. Co.

328 Powder-Actuated Fastening Methods

Powder-actuated tool catalog, form B-141, 12 pages, answers questions about powder-actuated fastening methods in maintenance, construction. Information on tools, fasteners. Charts, graphs, and pictures facilitate understanding of technical phases, principles behind powder-actuated fastening. Complete line of fastening tools, fasteners, powder charges, hammer-in fastening tools, fasteners illustrated. — Ramset Fastening System.

329 PVC for Corrosion Problems

Full description of "Boltaron" PVC 6200 rod, hex, angle and square stock. For use in meeting corrosion problems. — Bolta Products Div., General Tire & Rubber Co.

330 Stud Drivers and Accessories

Ten page catalog 58-517-S of Remington stud drivers and accessories describes, illustrates powder-actuated tools, special guards, adaptive kits, power loads, studs, other items. Charts show how Remington equipment fits and functions on a wide range of structural materials like outlet boxes, roofing and siding sections, etc. — Remington Arms Co., Inc.

Pipe, Tube, Hose & Conduit

331 Aluminum Products

Alloys, dimensions, specs, for Revere aluminum products including sheet, bar, tube, extrusions, and specialty industrial products are given in 36 page bulletin. Illustrated with end use. — Revere Copper and Brass Inc.

332 Aluminum Tube

Comprehensive 48 page catalog on formulation, metallurgy, manufacture, and final end uses of all categories of Revere aluminum tube. — Revere Copper and Brass Inc.

333 Armored Bundles

Four page brochure 759 describes "Dekoron" bundled tubing with plastic and/or steel armor. — Samuel Moore & Co., Dekoron Products Div.

334 Brass Pipe, Copper Tube and Fittings

"Anaconda" publication B-1 contains general information, engineering data and installation procedures for brass pipe and copper tube in heating, refrigeration, air conditioning, and plumbing applications. — The American Brass Co.

335 Bundled Metal Tubing

Four page brochure 760 describes parallel construction "Dekoron Metl-Cor" bundled metal tubing with polyethylene sheathing. — Samuel Moore & Co., Dekoron Products Div.

336 Continuous Weld Pipe

"Jal-Con-Weld" pipe is manufactured by the continuous weld process. The pipe is available in sizes ½ in. through 4 in., black or galvanized, plain end, threaded and coupled, or threaded only. — Jones & Laughlin Steel Corp.

337 Copper and Brass Products

Thirty-two page catalog listing all standard Hussey copper and brass products, including pipe and tubing. Tabular material shows OD measurements, wall thicknesses and weight per linear foot. — C. G. Hussey & Co.

338 Copper Tube

A useful guide for heating, refrigeration, air conditioning, plumbing, and architectural specification, covering copper water tube, commercial

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brass and copper tube, copper refrigeration tube, red brass and copper pipe, threadless pipe, copper drainage tube, integral finned tube, small gauge seamless precision copper tube. — Reading Tube Corp.

339 Corrosion Resistant Pipe and Tubing

Catalog describes analyses and grades of tubing and pipe available in the following size range: Pipe — 2½ to 30 in. IPS in Schedules 20 through 160; 5 to 30 in. IPS in Schedules 5 and 10. Tubing — 3 to 5 in. OD with walls 0.154 to 0.375 in.; 5 to 48 in. OD with walls 0.050 to 1 in. Engineering data and tables are also included. — C. A. Roberts Co.

340 Engineering Catalog

This book offers descriptions, properties, chemical resistances, detailed specifications and installation data covering polyvinyl chloride pipe, fittings, valves and sheet stock. — The Colonial Plastics Mfg. Co., Van Dorn Iron Works.

341 Expanded Polystyrene Insulation

Eight page brochure, which discusses "Uni-Crest," United Cork Companies' expanded polystyrene insulating material, describes the product, lists its physical properties, gives standard dimensions, and recommends thicknesses for a wide range of temperature conditions. Photos and drawings illustrate various uses and the text discusses simplified techniques of installation and finishing. — United Cork Companies.

342 Flame Resistant Vapor Barriers

Folder contains descriptive information, technical data and actual samples of "Pyro-Kure", flame resistant vapor barriers for duct and insulation facing and pipe jacketing. Underwriters' Laboratories ratings and physical property summaries are also included in this folder. — American Sisalkraft Corp.

343 Handbook of Tubular Products

Compact handbook 393-B, 40 pages, 6 x 9 in., contains dimensions, weights, test pressures, and specifications for Bethlehem continuous butt-weld and Bethlehem electric resistance weld steel pipe. Standard and tentative specifications for welded and seamless steel pipe are also included. — Bethlehem Steel Co.

344 Pipe for Storm Water Drainage

Ten page folder TR-252A describing, illustrating Johns-Manville "Transite" asbestos-cement pipe for storm water drainage and storm sewer systems for control of rain from roof level to outfall. Covers economic advantages. Contains job photographs, system diagrams, information about "Transite" fittings available to complete installations. Also design data, guide specifications. — Johns-Manville Sales Corp.

345 Plastic Pipe

Rigid polyvinyl chloride (PVC) plastic pipe known as "Riviclor" has excellent resistance to corrosive liquids and gases, light weight, high strength, and is ideal for industrial piping. NSF-approved for drinking water. Technical data given in 8 page bulletin CE-56. — American Hard Rubber Co., Div. Amerace Corp.

346 Plastic Pipe, Fittings and Valves

Tough, chemical-resistant "Ace-Ite ABS" plastic pipe, fittings and valves are covered in highly informative bulletin CE-80. Sixteen pages of data include properties, chemical resistance, loss of head, installation procedures. — American Hard Rubber Co., Div. Amerace Corp.

347 Plastic Pipe, Fittings and Valves

Sixteen page catalog 380 on "Uscolite" light weight, corrosion resistant thermoplastic pipe, fittings and valves recommended for corrosive chemicals, purified water, solutions sensitive to contamination. Information on applications, advantages, physical properties, corrosion resistance and installation is given and pipe, screw fittings, socket fittings, valves, sheet, slab and rod is included. — Mechanical Goods Div., United States Rubber Co.

348 PVC Pipe

Revised PVC pipe catalog, 40 pages, edition contains new corrosion ratings, expanded information on thermal compensation, vacuum service, abrasion resistance. Installation and application sections have been enlarged. Diagrams illustrate methods of joining PVC to other piping materials. Includes dimensional data and working pressures for schedule A tubing. — A. M. Byers Co.

349 Radiant Panel Heating with Steel Pipe

A 48 page booklet describing radiant panel heating and giving information on design and suggestions for laying out and installing steel pipe for such systems. It contains a question and answer section and is well illustrated. — Committee on Steel Pipe Research.

350 Seamless Welding Fittings

Preliminary guide to selection of welding fittings for pressure uses given in technical bulletin FB-78 on B&W seamless welding fittings. Includes materials guide, breakdown of specifications by grade and analysis, mechanical properties, and listing of types and sizes. Includes tips on welding practices, and discussion on effects of alloying elements. — The Babcock & Wilcox Co., Tubular Products Div., Welding Fittings Dept.

351 Stainless Steel Tubing and Pipe

Sixty page book, STP-1, has complete information on Republic's "Electrunite Enduro" stainless steel tubing and pipe. Manufacturing processes and applications described in detail. Design data, corrosion resistance tables, fabricating helps included. Specifications covering tubing and pipe are listed and briefly outlined. Many photographs illustrate various points of manufacturing and use of these products. — Republic Steel Corp., Steel and Tubes Div.

352 Stainless Steel Tubing and Pipe

Complete catalog on "Electrunite" stainless tubing and pipe which includes the following information: Development and classification of stainless steels, properties of tubing, analyses, fabricating data, tubing data tables and engineering data. — C. A. Roberts Co.

353 Steel Couplings and Pipe

New bulletin gives sizes, lengths, threads, weights and carton content of Wheatland steel pipe couplings plus complete specifications on Wheatland steel pipe, including standard, extra strong, double extra strong and structural pipe. Illustrated, file-size bulletin printed in two colors on durable stock. — Wheatland Tube Co.

354 Steel Pipe Snow Melting and Ice Removal Systems

A 32 page booklet covering the use of steel pipe for snow melting and ice removal installations. It contains design information and discusses good installation practices. It is well illustrated and carries a question and answer section. — Committee on Steel Pipe Research.

355 Steel Tubular Products

A 16 page catalog TB-417 covers B&W seamless and welded pressure tubing and pipe, seamless welding fittings and forged steel flanges, and mechanical tubing; all in carbon, alloy or stainless steels. Includes charts of tube and pipe properties, and available sizes and types of welding fittings and flanges. — The Babcock & Wilcox Co., Tubular Products Div.

356 Tube and Pipe

Twenty-four page publication on Revere tube and pipe for general construction describes all major applications of copper and copper alloy tube and pipe, with illustrations and data. — Revere Copper and Brass Inc.

357 Waste Drainage System

Sixty page engineering handbook on properties, performance of "Vulcathene" waste drainage systems. Describes "Vulcathene" fittings, sinks, traps, pipe, etc., with technical and dimensional data, drawings. Includes section on "Polyfusion" method for joining "Vulcathene" pipe and fittings, installation notes, chemical resistance chart, tables of thread sizes, pressure and temperature information. — American Vulcathene Div.

358 Wrought Iron Heat Exchanger and Condenser Tubes

Ten page booklet cites actual installations where cold drawn wrought iron and other metal tubing are compared under identical service conditions. Lists corrosive factors and cost-per-foot-per-year figures. Contains table of tubing sizes, gauges, calculated weights, working pressures, tolerances. Physical and mechanical properties also listed. — A. M. Byers Co.

359 Wrought Iron Pipe

4-D wrought iron pipe catalog, 48 pages, contains complete mechanical information on Byers wrought iron piping products, including standard, extra and double extra strong weights, casing, tubing, line and drive pipe, fittings. Sections on identification, specifications, pipe standards and measurements, instructions on ordering. Many informative tables of reference data. — A. M. Byers Co.

Piping Specialties, Steam Traps, Expansion Joints, Pipe Hangers, Etc.

360 Automatic Regulating Valves

Bulletin 954 describes automatic regulating valves for controlling the flow, pressure or temperature of hot water and steam in pipes or related items. — Klipfel Valves, Inc.

361 Bellows Expansion Joints

Engineering data and specifications for unreinforced series 50 and reinforced series 150 Tube-Turn bellows expansion joints in sizes 3 through 30 in. Also, expansion compensators for 60 psi and 150 psi service, in sizes through 3 in. — Tube Turns Div. of Chemetron Corp.

362 Building Drainage Products

Bulletin 56-1 describes Zurn "Thinline" systems for supporting wall type fixtures; roof drains; floor drains; interceptors; "Supremo" cleanouts; "Inspecdor"; "Shoktrol"; hydrants; swimming pool equipment; and pipe line strainers. Includes engineering drawings, photographs, dimensions, specification and application information. — Zurn Industries, Inc., Plumbing Products Div.

363 Centrifugal Blowdown Separator

Wilson centrifugal blowdown separator, described in bulletin 30, is the answer to safe, economical boiler blowdown. It is used in place of a conventional blowdown tank or basin. — Wilson Engineering Corp.

364 Copper Tube

A useful guide for heating, refrigeration, air conditioning, plumbing, and architectural specification, covering copper water tube, commercial brass and copper tube, copper refrigeration tube, red brass and copper pipe, threadless pipe, copper drainage tube, integral finned tube, small gauge seamless precision copper tube. — Reading Tube Corp.

365 Expansion Compensators

Bulletin 205 describes new high pressure expansion compensators in stainless steel and bronze. Designed to replace previous methods, such as slip joints, swing joints, pipe loops, or bends; units available for pressures to 175 psig, temperatures from −60 to 250 F, with 1¾ in. compression and ¼ in. extension. — Flexonics Corp. (A Subsidiary of Calumet & Hecla, Inc.)

366 Expansion Joint Design Guide

Twenty-eight page expansion joint design guide 182 covers engineering application and selection data. A discussion of the various types of expansion joints on the market, types of pipe line motion solved by expansion joints, expansion joint design considerations, installation instructions, and selection data is included. — Flexonics Corp. (A Subsidiary of Calumet & Hecla, Inc.)

367 Expansion Joints

Six page bulletin EJC-591 on Badger S-R expansion joints is a brief digest of information on the nomenclature and selection of these joints and a guide to making inquiries for specific application. Contains general information on flanges, liners, covers, temperature ratings and other material of interest to joint users. — Badger Mfg. Co.

368 Expansion Joints

Twenty-eight page catalog 758 on U. S. Rubber expansion joints to prevent stresses due to expansion and contraction, insulate against the transfer of vibration and noise, and compensate for misalignment. Function, applications, advantages, features described and data on spool type, rectangular type, light weight type, and belt type are given. — Mechanical Goods Div., United States Rubber Co.

369 Expansion Joints

"R/M" rubber expansion joints absorb pipe movement. They respond to the slightest pressure, preventing stress and strain on pipe and fittings that can cause trouble in ventilating and air conditioning systems. They also insulate components against destructive vibration and noise, and compensate for misalignment. — Raybestos-Manhattan, Inc., Manhattan Rubber Div.

370 Expansion Joints

Twelve page bulletin EJ-1917 on "Yarway Gun-Pakt" expansion joints describes features and advantages of this unique slip type joint. Gives dimensions, weights, and other information helpful to selection. Tells how to figure expansion of pipe lines; gives installation suggestions, etc. — Yarnall-Waring Co.

371 Flexible Pipe Connectors

Engineering data and specifications brochure on "Allflex" flexible pipe connectors for pumps, air conditioning equipment, finned tube radiators; and pipe line connections subject to vibration, expansion, and all flexation problems. Tabular data, diagrams, and installation photos show best methods to overcome these problems. Available in stainless, bronze, monel, and steel. — Allied Metal Hose Co.

372 Forged Brass Cleanable Strainers

Bulletin 50-HYS covers forged brass "Y" type cleanable strainers of pipe thread, SAE flare and OD solder types. Line connections need not be broken for cleaning. Recommended for air, light oil, gas, water, brine, steam and refrigerants. Connection range ¼ through 1 in. FPT, ¼ through ⅝ in. flare, ¼ through 1⅛ in. ODS. Meshes available: 100, 80, 60 and 40. — Henry Valve Co.

373 Hose Design Guide

Thirty-six page design catalog 170 covers application and selection of metal hose. Various end fittings are illustrated and described. — Flexonics Corp. (A Subsidiary of Calumet & Hecla, Inc.)

374 Impulse Steam Traps

Eight page bulletin T-1743 covers three lines of "Yarway" impulse steam traps — for normal condensate loads, light condensate loads, and extra heavy condensate loads. Gives capacities, weights, dimensions, prices and other information helpful to selection and purchase. Also includes information on "Yarway" pipe line strainers. — Yarnall-Waring Co.

375 Metal Hose for Diesel Installations

Engineering data and specification brochure on metal hose for diesel applications. Charts and diagrams illustrate best way to handle flexation and vibration problems in engine exhaust, air intake and oil lines, water lines, etc. Typical installations are diagrammed, such as 90 deg bends, lateral and vertical offset, expansion and contraction, etc. — Allied Metal Hose Co.

376 Overhead Valve Operators

Bulletin shows the 10 sizes of Babbitt adjustable sprocket rims and guides for operating overhead valves from the floor, as well as the range of valve handwheel diameters they will fit. Also shown are the list prices of the rims and guides as well as the chain which fits them. — Babbitt Steam Specialty Co.

377 Packless Expansion Joints

Robertshaw packless expansion joints for water or steam are described in bulletin 65. Pipe sizes ¾ through 6 in. Working pressures to 150 psig. All metal seamless bellows, multi-ply for greater flexibility at higher pressures and longer life. Brass, monel, stainless steel materials available. — Fulton Sylphon Div., Robertshaw-Fulton Controls Co.

378 Pipe Hangers and Supports

Catalog PH58, 128 pages, shows illustrations, sizes, weights, capacities for rigid, adjustable, variable spring and constant support hangers; clamps, rolls, clevises, screw eyes and clips; flanges, rings, brackets, concrete inserts for supporting piping. Whether you're hanging 55 tons of main steam or ¼ in. copper tubing, what you need is shown. — Grinnell Co., Inc.

379 Power and Process Piping

New 24 page bulletin 60-B features facilities and procedures for the fabrication and erection of power piping systems and industrial process piping. Profusely illustrated with photographs of actual installations and equipment for producing carbon and alloy steel piping in all sizes. — Midwest Piping Co., Inc.

380 Purifiers

Eight page bulletin 803 describes and illustrates the various types of Anderson "Hi-eF" purifiers for removing liquid and solid entrainment from steam, air, gas and vapors. — The V. D. Anderson Co., Div. of International Basic Economy Corp.

381 Rubber Expansion Joints

Bulletin describes and illustrates all types of expansion joints — right angle, tapered, spool, sleeve, offset, single and multiple arch, etc. Contains data on installation; face-to-face dimensions; allowable movement; pressures; standard drilling of flanges; etc. — Goodall Rubber Co.

382 Safety and Relief Valves

Bulletin 660 illustrates and describes safety relief valves. Safety valves are approved by American Society of Mechanical Engineers suitable for steam and air service with relief valves suitable for liquid service. Valves furnished in either bronze or cast iron body with screwed or flanged connections. — O. C. Keckley Co.

383 Selecting Steam Traps and Specialties

Thirty-six page booklet giving sizing information and correct methods of installation also describes and illustrates four types of steam traps and air release valves and pipe line strainers. — The V. D. Anderson Co., Div. of International Basic Economy Corp.

384 Stainless Steel Bellows

Comprehensive catalog which includes application and engineering data on laminated stainless steel bellows. Included is data on expansion compensators, expansion joints, vibration absorbers, flexible connectors and pipe guides. — The U. S. Flexible Metallic Tubing Co., Keflex Mfg. Div.

385 Stainless Steel Hose

Engineering data, specifications on "Allflex" stainless steel hose from ¼ through 16 in. sizes given in data sheet SSDS562. Engineering information and data on pressure, flexibility, applications, etc. Threaded and flanged end fitting connections. Applications include vibration taming, expansion compensation, misalignment correction, etc. Also available in monel, bronze, carbon steel. — Allied Metal Hose Co.

386 Steam Trap Book

Forty-eight page steam trap manual and catalog includes complete data on open float and thermostatic traps for preheat and reheat coils, converters, etc., standard steam traps for all pressures, pipe strainers to 6 in. in steel and high tensile iron. Contains valuable data on trap selection, installation, testing, and maintenance. — Armstrong Machine Works.

387 Steam Trap Selection

Bulletin containing six charts shows how to determine amounts of condensate formed in heating of liquids and solids, in submerged heating surfaces, with excess heat exchange area, in coil type space heaters and in air heating coils. Sixth chart shows application of trap safety factors. — Yarnall-Waring Co.

388 Steam Traps

General catalog 101M lists complete line of temperature and pressure instruments for indicating, recording and controlling temperature, pressure and humidity. Information on patented rotating valve steam trap is included. Because the valve never seats twice in the same position, the trap will not leak due to wire drawing of the valve or seat. — H. O. Trerice Co.

Thirty-five catalogs or bulletins on piping specialties, steam traps, expansion joints, pipe hangers, etc. that are available on request are described here. Each item has its own title to make it easy for you to locate literature for which you have need.

389 Steam Traps

"Sterlco" float and thermostatic traps and thermostatic radiator traps, both equipped with the "Sterlco" vacuum thermostat, described in bulletin 102-202. Construction enables traps, if damaged, to fail in closed position. Cold radiation indicates trap needs attention, reducing maintenance problems. All thermostatic elements external. Built for pressures to 100 psig. — Sterling, Inc.

390 Thermal Expansion in Piping

Bulletin 31A describes and illustrates use of flexible ball joint expansion units in sizes from ½ to 16 in. for handling thermal expansion and torsional stresses in power and plant piping. Any steam pressure, 0 to 750 psi, or higher. Complete with diagrams, data, and photographs. — Barco Mfg. Co.

391 Thermostatic Radiator Valves

Thermostatic radiator valves to provide individual room or area temperature control on two pipe steam or hot water systems described in "Thermotrol" bulletin 501. Completely self contained, no external power source. Ideal for modernizing and inexpensive control systems for new construction. Sizes are ½, ¾ and 1 in., in all body patterns. — Sterling, Inc.

392 Thermostatic Steam Traps

Bulletin describes Riggio bronze body, angle or straight through, ½ to 1 in. thermostatic steam traps and semi-steel body, angle or straight through, ½ to 2 in., for steam pressures from vacuum to 250 lb psi, temperature 450 F, without changing valves, seats. Bellows of phospher bronze or stainless steel. — Frank D. Riggio Co., Inc.

393 Thermostatic Traps

Webster series 7 is a diaphragm type thermostatic trap designed for low pressure vapor and vacuum steam heating service. It is recommended for all types of radiators, drip points, steam-using equipment, and other applications within its pressure and capacity range. — Warren Webster & Co., Inc.

394 Thread Sealant

Leaflet describing "Ribbon Dope" thread sealant by Permacel. A new pipe joint sealant in dry ribbon form. — Permacel.

Pumps & Pumping Equipment

395 Centrifugal Pumps

Complete listing of Taco LP series centrifugal pumps, sizes 1¼ through 6 in., with stuffing boxes or mechanical seals, ball or sleeve bearing motors and frames, center-line discharge and rotatable casings. Included are selection charts for 1750 and 3450 rpm and information on selection of proper impeller and motor horsepower. — Taco Heaters, Inc.

396 Centrifugal and Turbine Type Pumps

Four page condensed bulletin illustrates and describes the Aurora centrifugal and "Apco" turbine type pumps, single and multiple stage, flexible and close coupled, horizontal and vertical. Includes description, features, typical applications, capacity and head range for each type of pump. Capacities 1 to 9000 gpm and heads to 600 ft. — Aurora Pump Div., The New York Air Brake Co.

397 Circulator

Brochure describing No. 1000 circulator for forced hot water heating systems includes flow curves, weights, dimensions, and product description. Also includes information relative to other accessory products such as combination air eliminator and flow check, tank drain, diversion fittings, ASME relief valves, tempering valves, and feedwater pressure regulators. — Watts Regulator Co.

398 Close Coupled Pumps

Bulletin 975-F gives complete information relative to mechanical and hydraulic features of close coupled pumps. Suitable for most pumping situations and especially desirable in limited space. Parts interchangeability permits low inventory. Application data included in bulletin. Rating tables simplify selection. — Buffalo Pumps Div., Buffalo Forge Co.

399 Condensation Pump and Receiver

Skidmore VC condensation pump and receiver described in bulletin 10-B. Used for returning condensate to boiler or other points from all types of steam heating or process equipment. Designed for rugged and dependable service, yet simple in construction to assure ease of accessibility. Complete engineering data and dimension table included. — Skidmore Corp.

400 Condensation Pumps

Economically designed for maximum efficiency with lower operating cost, Skidmore type HS pump is described in bulletin 14-B. Operates at wide range of pressures, including high temperature in condensation pump service. Pump has low receiver inlet. Bronze fitted throughout with impeller of bronze construction, keyed and locked on stainless steel shaft. — Skidmore Corp.

401 Condensation Pumps

The 4100-4200 series condensation pumps for low pressure systems up to 15,000 sq ft EDR are described in bulletin 700. Efficient, non-overloading centrifugal pumps for quiet operation. Three basic tank sizes for close adjustment to boiler water level. Steel or cast iron receivers. Built in simplex or duplex models with several different control systems. — Sterling, Inc.

402 Cradle Pumps

Descriptive material on a complete line of cradle-mounted pumps, ¼ through 100 hp, for deliveries of up to 3200 gpm, heads to 525 ft. — Ingersoll-Rand Co.

403 Double Suction Pumps

Bulletin 955S gives complete data on Buffalo double suction, single stage centrifugal pumps. Information includes capacities, approximate dimensions, and construction details. Recommended for almost any service where clear water is to be handled. Special section on Buffalo Underwriter fire pumps. — Buffalo Pumps Div., Buffalo Forge Co.

404 End Suction Centrifugal Pumps

Bulletin 500 describes Weinman single stage end suction pumps having a virtually unlimited application and providing economical, efficient pumping performance to meet a great variety of pumping requirements. Compact and easy to maintain, they are available in 32 models with capacities ranging from 10 to 2000 gpm. — Weinman Pump Mfg. Co.

405 End Suction Pumps

Thirty-six page bulletin B-2300 on Peerless "Fluidyne" horizontal end suction centrifugal pumps for general purpose service. Motor sizes from ¼ to 150 hp, capacity range from 10 to 5500 gpm. Liquids can be pumped against heads up to 260 ft. Dimensional data, selection charts and other information included. — Peerless Pump, Hydrodynamics Div., Food Machinery and Chemical Corp.

406 Flexible Connectors for Pumps and Compressors

Bulletin FP-4 describes "Flexpipe" connectors, in sizes through 16 in., for absorbing vibration and travel in piping near pumps and compressors. Gives construction, typical installations, engineering data on tin-bronze, hot-dipped galvanized steel and stainless steel connectors. Also shows variety of end fittings available. — Anaconda Metal Hose Div., The American Brass Co.

407 Fuel Oil Pumping and Heating

Fuel oil pumping, heating units to prepare and deliver heavy fuel oil at proper pressure and temperature for oil burning systems described in bulletin 40. Capacity range 1 to 75 gpm, 7000 to 540,000 pph of steam. Various models, single or twin, electric or steam drive. Also built to specification. — National Airoil Burner Co.

408 General Service Pumps

Bulletin 100 covers Weinman type AC "Unipumps" designed to deliver efficient pressure boosting service, hot and chilled water circulation and to meet many other general purpose pumping requirements. "Unipumps" are available in 21 different models with output ratings from 10 to 260 gpm. — Weinman Pump Mfg. Co.

409 Horizontally Split Pumps

Descriptive material on a complete line of horizontally split pumps up to 10 in. discharge size. Horsepowers to 400, capacities to 4000 gpm, heads to 1100 ft. — Ingersoll-Rand Co.

410 Motor Pumps

Descriptive material on a complete line of close-coupled "Motorpumps," ¼ through 75 hp, for deliveries of up to 3200 gpm, heads to 650 ft. — Ingersoll-Rand Co.

411 Motors

Howell condensed full-line catalog FL-2 contains photographs, application and performance information, electrical and mechanical types available, enclosures for single and polyphase a-c motors in size range 1/6 through 300 hp. — Howell Electric Motors Co.

412 Multistage Pumps

Bulletin 980 gives complete information on Buffalo class RR single suction multistage pumps, including details and instructions for installation and operation. These pumps are available in two- and four-stage models for clear water high pressure, high temperature service. Capacities are to 900 gpm. — Buffalo Pumps Div., Buffalo Forge Co.

413 Pump Condensed Application Guide

Application guide APB 100.17A is designed to aid in tentative selection of pump type and capacity as a preliminary to calling in engineer for specific information on dimensions, ratings and specifications. Briefly covers Fairbanks-Morse line of pumps to meet practically every pumping requirement. — Fairbanks, Morse & Co.

414 Pump Valve Units

Eight page bulletin describing valve units designed to fit any reciprocating pump, old or new. Made in 17 sizes, they meet over 300 variations in installation requirements. Included are illustrations and descriptions of the component parts, pressure-temperature ratings, and a table of seat sizes and dimensions. — Durabla Mfg. Co.

415 Pumps

Pumps for every purpose, including condensate, boiler feed, fuel oil, sump, sewage, chemical feed, centrifugal transfer and fuel oil pump and heater sets are described. — Walter H. Eagan Co., Inc.

416 Sewage Pump

Submersible sewage pump for residential applications and for pumping septic tank effluent is described in bulletin SE-850. Features a 2 in. discharge, capacitor type motor and micro-switch control. Can be supplied as a complete package with basin and gastight cover. — Weil Pump Co.

417 Side Suction Pumps

Twelve page bulletin B-2100 on Peerless "Aqua Line" general purpose horizontal centrifugal split case pumps for hot and cold water, circulation and boosting. Packed and sealed types, temperature range for the packed type being to 250 F and the sealed to 180 F. Dimensions, construction details, selection charts, sample specifications included. — Peerless Pump, Hydrodynamics Div., Food Machinery and Chemical Corp.

418 Split Case Centrifugal Pumps

Bulletin 1200 describes Weinman type L single stage split case centrifugal pumps for high, medium or low head requirements. Ideal for municipal, public building and industrial use; chilled water or condensate circulation and liquid handling in paper mills, chemical plants, distilleries, refineries. Thirteen models with outputs 100 to 600 gpm. — Weinman Pump Mfg. Co.

419 Split Case Pump

Horizontally split case pump with mechanical seal is described in bulletin AY-1850. Applications include air conditioning, water supply booster service, hot and cold water circulating. Capacities to 1800 gpm; heads to 400 ft. — Weil Pump Co.

420 Turbine Type Pumps

New 8 page bulletin illustrates and describes the latest design features of the "Apco" turbine type pumps. Also included are exploded views, selection tables, limitation charts, dimensions, construction specifications, and detailed engineering-architect specifications. Capacities range up to 150 gpm, pressures to 300 psi, and temperatures to 275 F. — Aurora Pump Div., The New York Air Brake Co.

421 Vertical Centrifugal Pump

Vertical design centrifugal pump, all ball bearing, floor mounted, flexible coupled, with mechanical shaft seal is described in bulletin VKY-6900. Applications include hot and cold water circulating, water supply booster service, condenser water circulating for air conditioning. Features: Economy and space saving. Requires much less space than conventional pump. — Weil Pump Co.

422 Vertical Condensation Pumps

Bulletin 21-C describes new Skidmore vertical CCVS condensate pump. Description, sectional view, engineering data, dimensions. Features close-coupled design, capacity range 500 to 10,000 ft EDR, discharge pressure from 20 to 40 lb. Three new single units available; duplex units furnished with either two float switches or automatic alternator. — Skidmore Corp.

423 Vertical Supply Pumps

Ten page bulletin B-142 on "Hi-Lift" pumps for producing 5 to 55 gpm from depths to 1000 ft, pressures to 50 psi. Employs positive displacement pumping action. Sizes for drilled wells 4 in. inside diameter and larger. Selection chart, pressure determination, calculating capacities, figuring water requirements, etc. — Peerless Pump, Hydrodynamics Div., Food Machinery and Chemical Corp.

424 Vertical Turbine Pumps

Bulletin 14 describes the types, construction, and applications of "FloWay" vertical turbine pumps, designed in several models for a broad range of industrial usage and which have a record of proven performance in pumping every fluid, corrosive or non-corrosive, hot or cold, volatile or non-volatile. Capacities up to 4000 gpm. — Fiese & Firstenberger Mfg. Inc.

Radiation, Surface & Coils

425 Central Air Conditioning

Engineering catalog with illustrative and descriptive information and complete selection data on central plant conditioners, multizone conditioners, sprayed coil units, heating-ventilating units, cooling and heating coils. This catalog is notebook type and is index tabbed for easy and quick use. — Thermal Engineering Corp.

426 Convector

Webster "Walvector," with excellent style, beauty and performance, is an elongated finned tube convector consisting of highly efficient heating surface and heavy gauge sheet metal enclosure designed for mounting along wall, close to floor line or under windows. Applicable to new construction, modernization. — Warren Webster & Co., Inc.

427 Convector Radiators

Catalog contains complete data and information on standard and institutional type convectors. — Modine Mfg. Co.

428 Convector Radiators

Catalog 4059, 32 pages, illustrates and fully describes how modern design and engineered heating efficiency combine to make Young convector radiators ideal for steam or hot water heating systems. Technical data, general application photos, construction features, steam and hot water capacities, dimensional data and engineering specifications are included. — Young Radiator Co.

429 Finned Surface Coils

Literature describes "H&M Turbu-Flo" finned coils for cooling or heating and for use with refrigerant, chilled or hot water, or steam (both standard and non-freeze types). — Halstead & Mitchell Co.

430 Heating and Cooling Coils

Bulletin A-55 describes Aerofin smooth-fin coil construction which permits close fin spacing without excessive air resistance or turbulence, resulting in greater capacity per square foot of face area. Shows various types of coils available, with index to bulletins containing complete data and information on each available type of coil. — Aerofin Corp.

431 Heating and Cooling Coils

Bulletin HC-2 gives descriptive information about complete line of heating and cooling coils. Direct expansion, cold water, hot water, standard steam, non-freeze steam and booster coils are all described as to construction, dimensions, and basic capacities. — Bohn Aluminum & Brass Corp., Danville Div.

432 Heavy Duty Coils

American-Standard has completed heavy duty coil line, first marketed in 1946, with introduction of steam distributing and hot water coils. The line, described in bulletin B-1518, provides coils for any air heating application where rugged construction, corrosion resistance, ease of access for cleaning, inspection and maintenance are essential. — American-Standard Industrial Div.

433 Hydronic Heating

The American-Standard hydronic heating ratings, data, dimensions catalog provides information on design and construction details of equipment for residential and commercial application — gas and oil fired cast iron boilers; gas and oil fired conversion burners; nonferrous and cast iron baseboard heating panels and wall-mounted convectors; cast iron radiators. — American Radiator and Standard Sanitary Corp., Plumbing and Heating Div.

434 Infra Red Radiant Heat

One of a series of 12 case history sheets that picture and describe use of "Panelbloc" overhead gas fired infra red radiant heat for various major commercial and industrial applications. Large size photographs of the installation are shown and actual gas consumption figures are given for various industries. — The Bettcher Mfg. Corp.

435 Panel Grids for Radiant Heating

"Anaconda" publication B-6 gives full information, including engineering data and suggested layouts, for using "Anaconda" panel grids (PG's) in ceiling or floor radiant panel heating systems. The panel grid is machine-formed, ready to install without further bending on the job. — The American Brass Co.

436 Pipe Coils and Fin Coils

Engineering data book on pipe coils and fin coils prepared especially for design engineers. This 48 page publication is a guide in the design of coils, with specific data on dimensional limitations, coil development formulas, and heat transfer factors. Numerous reference and design tables are included. — Rempe Co.

437 Radiant Baseboards

Six page descriptive folder on Burnham "Base-Ray" cast iron radiant baseboards, showing the No. 7 and the new No. 9 models. — Burnham Corp., Heating & Cooling Div.

438 Radiant Ceiling

The story of the Burgess-Manning ceiling for radiant panel heating, radiant panel cooling, and acoustical control is given in 16 page booklet. — Burgess-Manning Co., Architectural Products Div.

439 Radiation

Condensed catalog containing two pages of information on each model of Shaw-Perkins "Panel-Vector" and "Airadiator" radiation. Descriptions, specifications, dimensions, ratings, etc. are included. Offers full literature on each model. — Shaw-Perkins Mfg. Co.

440 Registers and Grilles

Catalog 58 covers "Fabrikated" grilles, registers and grilles for warm air heating, perimeter heating and cooling. — The Independent Register Co.

441 Steam Heat Transfer Surface

Catalog 956 describes "Grid" cast iron steam heat transfer surface unit heaters, blast heaters, and radiators, and illustrates one-piece construction. Included are air distribution charts, heating capacities, conversion tables, and specifications. This four-section catalog with tab index is well illustrated. — D. J. Murray Mfg. Co.

442 Three-Way Functional Ceiling

The completely self-contained Burgess-Manning three-way functional suspended ceiling offering radiant panel heating, radiant panel cooling and acoustic control is described in 12 page technical bulletin. — Burgess-Manning Co., Architectural Products Div.

443 Water Cooling Coils

Catalog 406 covers complete line of McQuay water cooling coils in four standard fin spacings for any requirement or design load. Catalog describes coil construction, offers example coil selection problems and includes a complete section on direct selection. Provides an easier, more accurate selection of McQuay water cooling coils. — McQuay, Inc.

444 Water and Refrigerant Coils

Catalog 5559 contains a full description of a complete line of water and direct expansion refrigerant coils. The catalog describes exclusive construction features, with physical and performance data. Piping diagrams, architectural and engineering specifications, and many illustrations are included. — Young Radiator Co.

Refrigeration Equipment for Air Conditioning

445 Absorption Chilling Systems

Six page catalog EM60-2236 describes York absorption water chilling systems and how they operate, with diagrams and illustrations. — York Corp.

446 Absorption Water Chillers

Color illustrated, four page folder gives various applications, sales advantages, cycle of operation, general description and operating cost data on Arkla-Servel absorption type series 3000 (steam-actuated) water chillers. — Arkla Air Conditioning Corp.

447 Air Conditioning and Refrigeration Controls

Fifty-six pages of precision controls ranging from thermo-expansion valves for commercial freezers to complete control packages for residential and commercial air conditioning. Engineering data section includes capacity tables, conversion tables, and typical heating-cooling systems diagrams. Stock condenser panels, evaporator panels and combination panels are also itemized. — General Controls Co.

448 Air Cooled Condensers

Bulletin AC-102 gives complete performance data, dimensions, and description on "H&M" air cooled condensers. There are four types: horizontal air flow, vertical air flow, centrifugal fan, and residential type. — Halstead & Mitchell Co.

449 Air Cooled Condensers

Bulletin 628 covers McQuay line of AB "Aircon" horizontal and vertical air flow air cooled condensers for all air conditioning and refrigeration applications. Sections on design and construction, capacity, selection data, specifications and winter operation, etc. are included. Complete working guide to waterless air cooled condensing. — McQuay, Inc.

450 Commercial Gas Air Conditioning

New four page process color folder designed to help dealers sell primarily small tonnage Arkla-Servel gas air conditioning equipment for commercial applications shows its advantages and contains color photos of typical installations and has room on the back for a personal message from a dealer to a prospect. — Arkla Air Conditioning Corp.

451 Compressors

Bulletin 100-H describes multiple cylinder compressors designed to handle any commercial or industrial load, at any temperature, with any refrigerant. — Frick Co.

452 Compressors and Condensing Units

Carrier customized reciprocating compressors and condensing units now permit a selection that is exactly right — no matter how strict the specification. Custom-tailored in over 1000 combinations, the capacities range from 5 to 200 tons. Thirty-six page catalog with charts, diagrams, ratings, physical data, is available. — Carrier Corp.

453 Condensers and Condensing Units

Catalog FAC-360 contains complete information on "Fandaire" air cooled condensers and condensing units for refrigeration and air conditioning applications. — Yuba-Aimco Div.

454 Condensing Units

Air and water cooled condensing units, air and water cooled condensers, "A" type evaporator coils, "H" type evaporator coils. — Welbilt Air Conditioning & Heating Corp.

455 Control for Flooded Systems

Bulletin 60-15 is a completely new piece of literature containing the latest information on Sporlan's

"Level-Master" control for flooded systems. The bulletin contains capacity tables for refrigerants 717 (ammonia), 12, and 22. It also describes the operation of the control and how it is installed. — Sporlan Valve Co.

456 Cooling Towers

Details on Acme "Econ-o-mizer" cooling towers featuring exclusive plastic deck with controlled water flow to provide more capacity per pound, per square foot plus easier installation and maintenance are given in catalog 362. Includes specifications, capacities, dimensions for all nine models. — Acme Industries, Inc.

457 Cooling Towers

New 28 page bulletin 207 covers complete line of fireproof cooling towers from 10 to 700 tons in single, factory-assembled units. Engineering drawings, capacity and performance data, selection tables, and description are given for blow-through, draw-through, centrifugal fan, and tubeaxial fan models. — Baltimore Aircoil Co., Inc.

458 Cooling Towers

Brochure describes in detail the various advantages of Fluor cooling towers. Covered are such features as structural framing and components, tower sheathing, filling (both redwood and the patented "Poly-grid" water distribution system), fan systems and other aspects which make Fluor towers famous for high performance and lower cost. — Fluor Products Co.

459 Cooling Towers

Bulletin describes "H&M" induced draft cooling towers with propeller fans (2 to 150 tons) for outside installation and centrifugal fan (5 to 30 tons) for indoor installation or use with ductwork. Take-apart models also available. — Halstead & Mitchell Co.

460 Cooling Towers

Bulletin covers complete line of Havens "Performance Proved" cooling towers, all featuring hot-dipped galvanizing after fabrication. Lists standard features and accessory items. Gives dimensional data, performance data, material and construction specifications. — Havens Cooling Towers.

461 Cooling Towers

A 4 page bulletin on new series 15 line of Marley "Double-Flow Aquatowers." Includes specifications, engineering data and illustrations. This line of towers bridges the gap between the series 14 "Double-Flow Aquatowers" and custom-engineered Marley industrial towers. — The Marley Co.

462 Corrosion Resistant Cooling Towers

A 4 page bulletin including specifications, engineering data and illustrations of the complete line of "Permatowers" — cooling towers designed for maximum resistance to corrosion. Capacities range from 5 to 75 tons. — The Marley Co.

463 Direct-Fired Water Chiller-Heater

New illustrated information sheet on recently-introduced Arkla-Servel gas direct-fired model DF-3000 absorption type water chiller-heater gives description, complete specifications, capacities with various chilled and condensing water temperatures, and dimensions of new 25 ton unit. — Arkla Air Conditioning Corp.

464 Evaporative Condenser Engineering Manual

Fourteen page bulletin 141 covers theory, construction, selection, installation, ducting, refrigeration piping and capacity control of evaporative condensers. Schematic drawings illustrate evaporative condenser operation along with psychrometric and entropy diagrams. Selection diagrams are given for refrigerants 12 and 22 and ammonia under both dry and wet operation. Pipe sizing tables included in bulletin. — Baltimore Aircoil Co., Inc.

465 Evaporative Condensers

New 24 page bulletin 107 covers complete line of evaporative condensers from 10 to 700 tons in single, factory-assembled units. Engineering drawings, capacity and performance data, selection tables, and description are given for blow-through, draw-through, centrifugal fan, and tubeaxial fan models. — Baltimore Aircoil Co., Inc.

466 Evaporative Condensers

Bulletin 50 describes line of Marlo evaporative condensers, in three types — horizontal, vertical, low silhouette — 20 sizes, capacities 3 to 250 tons. Bulletin includes photographs, drawings, construction features, performance charts, ratings and specifications. Additional data is also included in this comprehensive 24 page bulletin. — Marlo Coil Co.

467 Evaporative Condensers

Condensers for refrigeration and air conditioning installations above 10 tons described. Table for selection of condensers for ammonia in 46 sizes from 12 to 354 tons per unit, and for "Freon" in 23 sizes from 15 to 425 tons. Photographs, diagrams show construction, operation. General specifications, dimensions and weights included. — Niagara Blower Co.

468 Evaporative Condensers

Full line of Vilter evaporative condensers detailed. Twelve page bulletin includes construction features of both VXF and VSC types with data and dimensions, performance charts and typical installation photographs. Condensers are available for refrigerants 12, 22 and ammonia and are offered in capacities of from 30 through 360 nominal tons. — The Vilter Mfg. Co.

469 Evaporative Water Coolers

Bulletin describes advantages, arrangements, and applications of closed circuit water cooling systems utilizing Recold "Dri-Fan" evaporative condensers. Includes dimensions, arrangements, specifications, and performance data. Multiple refrigeration compressor applications, industrial water cooling applications, and their features, along with typical installations and methods of figuring for selection are also included. — Recold Corp.

470 Expanded Polystyrene Insulation

Eight page brochure, which discusses "Uni-Crest", United Cork Companies' expanded polystyrene insulating material, describes the product, lists its physical properties, gives standard dimensions, and recommends thicknesses for a wide range of temperature conditions. Photos and drawings illustrate various uses and the text discusses simplified techniques of installation and finishing. — United Cork Companies.

471 Fluorinated Hydrocarbon Refrigerants

General discussion of the "Freon" refrigerants, including those in common use and others still under development, is given in bulletin on properties and applications. — E. I. du Pont de Nemours & Co., "Freon" Products Div.

472 Gas Powered Air Conditioning

Air conditioning equipment, powered by gas, has been in successful operation in commercial and industrial buildings. The various refrigeration and dehumidification cycles are described with data on characteristics, application and economic considerations. For guidance of engineers, specifications are given for the various systems that are covered in this comprehensive article. — Industrial and Commercial Gas Section, American Gas Association.

473 Heat Pump

New National Thermatic "Straight Forward" heat pump, when in heating cycle, operates straight forward, eliminating the defrost cycle except under freak weather conditions. The complete system is made of building block units which may be selected to suit vertical, horizontal, or counterflow systems. — National Thermatic Corp.

474 Heat Pumps

More than 175 units are listed on "Galaxy" reference chart. Included are 136 air conditioning products and 49 gas and oil fired furnaces. Divided into three parts (unitary air conditioners, heat pumps, furnaces), chart gives series designation and specifications. Designed for easy reference in determining right unit for a particular job. — Typhoon Air Conditioning Div., Hupp Corp.

475 Heat Pumps

Full line wall chart SA-60-1 illustrating and giving specifications for unitary air conditioners, furnaces, heat pumps, compressors and condensing units, packaged water chillers, air handling units, room type air distributing units, condensers, electronic air cleaners, etc. — Westinghouse Electric Corp., Air Conditioning Div.

476 Humidity Control Summer Air Conditioner

Type 925 Mueller "Climatrol" humidity control summer air conditioner not only cools but brings humidity down to comfortable level, regardless of the outside temperature. Unit provides three-way operation: cooling, 2 hp operation; cooling with 4 hp; and dehumidification only. — Mueller Climatrol Div. of Worthington Corp.

477 Ice Accumulator Unit

"Ice-Cel" ice accumulator unit for high peak load in air conditioning, such as churches, motels, mortuaries, etc., is described in section BAE. — Dole Refrigerating Co.

478 Indoor Cooling Towers

A 6 page bulletin including engineering data, specifications and illustrations of the complete line of Marley "Aqua Coolers" — cooling towers designed especially for indoor installations ranging from 5 to 90 tons. — The Marley Co.

479 Induction Conditioners

Sixteen page catalog MS115 features the York "Hi-I" induction conditioners for multi-room buildings, in which both cold and warm water are always available to provide either heating or cooling. — York Corp.

Refrigeration equipment and products of many, many types are essential components of air conditioning systems. Among the literature described in this classification of Heating, Piping & Air Conditioning's trade literature supplement is included publications on water chilling systems, controls, condensers, compressors, condensing units, cooling towers, evaporative condensers, insulation, heat pumps, ice accumulators, motors, filter-driers, instruments, valves, and refrigerants.

480 Inherent-Protected Three-Phase Motor

Howell inherent-protected open motors bulletin M-1986A gives selection data on new line of U/L approved three-phase, open ¼ through 3 hp, a-c motors, self-protected from both temperature and current against severe overloads, stalling, single phasing, unbalanced voltage, high ambient temperatures and motor ventilation obstruction. — Kingston-Conley Div., Howell Electric Motors Co.

481 Low Silhouette Cooling Towers

Bulletin covers complete V series line of Havens low silhouette packaged cooling towers. Gives dimensional and performance data. Gives construction features and material specifications. Also includes minimum maintenance features and tips on installation. — Havens Cooling Towers.

482 Multi-Drive Compressor Units

The new "Brunner" line of multiple drive compressors, 7½ through 40 hp, for industrial uses is described in bulletin 775. In addition to product features, specifications are listed for refrigeration compressors, semi-hermetic, direct drive condensing units, and compressors. Capacity curves are presented. — Dunham-Bush, Inc.

483 Packaged Cooling Towers

Bulletin covers all Havens VM series packaged cooling towers that are shipped pre-assembled. Gives performance data, engineering data, dimensional data and construction features. — Havens Cooling Towers.

484 Packaged Liquid Chillers

Four page bulletin RS2E describes air or water cooled air conditioning units, and packaged liquid chillers. Includes photos and specifications. — Curtis Mfg. Co.

485 Packaged Water Chillers

New 8 page brochure 535-A contains full details on Acme's compact, low-cost model HE factory packaged chiller line . . . eight models, 20 through 125 tons. Includes specifications, construction details, capacity data, dimensions plus complete information on features and advantages of HE chillers. — Acme Industries, Inc.

486 Radial Compressors

Capacity ratings on Chrysler Airtemp compressors and condensers for commercial and industrial air conditioning and refrigeration. The 40 page data book illustrates and lists the advantages of the Chrysler radial compressors and condensers and illustrates roughing-in dimensions for the various compressor units. — Airtemp Div., Chrysler Corp.

487 Reciprocating Compressors

Complete information on Vilter VMC reciprocating type refrigerants 12 and 22 compressors is given. Offered in capacities of from 20 hp through 200 hp, these high speed 2, 4, 6, 8, 12 and 16 cylinder machines are described in a 12 page bulletin. Construction features, dimensional data, application possibilities are included. — The Vilter Mfg. Co.

488 Refrigerant Filter-Driers

Bulletin 40-V87 on "Dri-Cor" refrigerant filter-driers, sealed and angle cartridge types. Moisture and acid removal plus Micronic filtration through two stages. Progressive filtration through granular desiccant bed, ceramic fired molded desiccant core. Split-second cartridge installation. Capacity range 1 to 165 tons. Connections ¼ in. M flare through 2⅛ OD solder. — Henry Valve Co.

489 Refrigerants

Four page, five color brochure containing vapor pressures, −50 to 150 F, plus selected physical data for "Genetron Super-Dry" refrigerants 11, 12, 22, 113, 114a. Describes uses of each refrigerant. — General Chemical Div., Allied Chemical Corp.

490 Refrigerants

Four page technical data bulletin describing physical properties and uses of "Ucon Brand" refrigerants — grades 11, 12, 22, 113 and 114. In addition, one page insert is enclosed listing product quality specifications of "Ucon" refrigerants. — Union Carbide Chemicals Co.

491 Refrigerated Purging

Twelve page guide tells how air in a refrigerating system affects efficiency; how to tell if purging is needed; comparison of manual and automatic refrigerated purging. Operation of refrigerated purger explained. Location of purge connections is discussed, as well as installation and operation. Two pages of comments by purger users. — Armstrong Machine Works.

492 Refrigeration Instruments and Valves

Catalog 76-R shows entire line of refrigeration gauges and thermometers, as well as regulating valves and solenoid valves. — Marsh Instrument Co., Div. of Colorado Oil and Gas Corp.

493 Water Chilling Systems

Six page catalog EM60-2235 describes the compact hermetic "Turbopak" for various water chilling applications, with information on its features. — York Corp.

See pages 2-29 and 2-31 for convenient reply cards you should use to request copies of these bulletins.

Sound & Vibration Control

494 Acoustical Panels

Bulletin 47 illustrates and describes Diamond perforated metal lay-in panels for modern acoustical ceilings and shows typical installations. All Diamond acoustical panels meet Federal specifications for incombustibility and have a glare-free baked-on finish which is easily washed and is not affected by moisture or any probable change in temperature. — Diamond Mfg. Co.

495 Aluminum Roof Curb

Bulletin SCE-89 describes self-flashing extruded aluminum "Sonotrol" roof curb. Easily installed, it provides a structurally stable support for the roof exhauster or motor or gravity operated dampers. This device helps to reduce sound build-up developed by roof fans. Installation instructions, drawings, specifications. — Penn Ventilator Co., Inc.

496 Duct Liner

Revised catalog ULD describes the use of "Ultralite" long textile type glass fiber insulation for duct wrap and duct liner. Characteristics and application methods, together with available and suggested thicknesses, are listed. Facings available, including new gray fire resistant coating, shipping information and specifications are given. — Gustin-Bacon Mfg. Co.

497 Hydraulic Vibration Snubbers

Bulletin 229A describes and illustrates hydraulic cylinder snubber units designed to restrict rapid vibration and momentary shock loads without limiting normal thermal expansion movements. Ideal for eliminating annoying noise and dangerous vibration stresses in piping assemblies, vessels, and stacks. Examples, diagrams, and illustrations. — Barco Mfg. Co.

498 Prefabricated Duct Connection

"Pre-Fab-Ric" prefabricated duct connection with available fabrics in various grades (canvas, asbestos, neoprene coated fiber glass, and neoprene coated asbestos), offering a type, size and price for all jobs, are described in bulletin. — Cain Mfg., Inc.

499 Prefabricated Duct Silencers

Eight page catalog 160 on "Uni-Silencer" prefabricated duct silencers that are guaranteed and bonded. Manufacturing information, acoustical information, pressure drop tables, pressure drop and air flow data, and acoustical performance are included. — Elof Hansson, Inc.

500 Silencers

Four page bulletin QC-205 R-3 describes "Conic-Flow" silencers designed especially for axial flow fans and the higher pressure systems. Features are described, acoustic performance shown, air flow and pressure drop tabulated, and dimensions given. Other standardized package silencers are briefly described and illustrated. — Industrial Acoustics Co., Inc.

501 Silencers

Four page bulletin QM-204R-2 covers "Mod-U-Size" silencers available in low pressure and standard models. Information is included on features, acoustic performance, air flow and pressure drop, dimensions and areas. — Industrial Acoustics Co., Inc.

502 Sound Control Curb

"QT" sound control curb is new Jenn-Air prefabricated, self-flashing unit designed to replace conventional power exhauster curbs, and described in bulletin 60-SC. Reduces exhauster sound power at inlet 90 percent, decreases air moving efficiency only 10 percent. Noise suppression equivalent to 18 ft of lined duct 14 in. square. — Jenn-Air Products Co., Inc.

503 Sound Traps

Four page folder describing the "Aircoustat" sound trap for use in silencing air handling systems. — Koppers Co. Inc.

504 Sound Trap Selection Manual

Twenty-four page "Aircoustat' data book describes complete line of "Aircoustat' sound traps. Also gives sizes and dimensions, as well as selection and ordering information. — Koppers Co. Inc.

505 Vibration Eliminators

Bulletin VE-313 contains engineering data and construction details on "Anaconda" vibration eliminators for absorbing vibration and dampening noise in air conditioning and refrigeration systems. Bulletin shows installations and lists advantages of using these vibration eliminators. — Anaconda Metal Hose Div., The American Brass Co.

> *Over 600 descriptions of catalogs, bulletins and other data available, without obligation, on request are described in these pages. The items are arranged by general classifications and each is titled to make it easy to find the ones of particular interest to you.*

Tools & Machines

506 Air and Electric Tools

New 63 page catalog 59-6 of "Sioux" air and electric portable tools includes air impact wrenches, nut runners, chisels, sanders, screw drivers; sanders, pipe threaders, polishers, valve grinding equipment, and abrasive discs. List of nationwide authorized service stations. Complete product descriptive and illustrative matter, including specifications. — Albertson & Co., Inc.

507 Bevel-Land Grinder

Catalog sheet describes latest addition to H. & M. line. Bevel-land grinder used for cleaning pipe cuts and placing land on pipe bevels. Uses an electric or air powered grinder to clean and bevel pipe. Works equally well on steel, stainless steel, high alloy steel or aluminum pipe. — H. & M. Pipe Beveling Machine Co.

508 Diamond Drills

Diamond drills and diamond bits for fast, economical drilling in reinforced concrete, brick, stone, tile, and other hard or brittle materials are described in bulletin 321. Several pieces of portable drilling equipment and diamond bits $\frac{1}{4}$ to 16 in. diameter are described. — E. J. Longyear Co.

509 Drill Anchors

Clearly illustrated catalog shows advantages, holding powers, operation, sizes and applications of five types of "Bulldog" drill/anchors. Shows how "Pow-R-Grip" ridges around shank of the drill/anchor provide easier penetration, greater holding power in hardest concrete. — Gregory Industries, Inc.

510 Drill Anchors

Bulletin on newest member of Omark line—self drilling expansion anchors for permanent fastening in concrete. Wide range of applications includes anchoring heavy machinery, hanging piping and fastening wood to concrete. Four types can be installed by any air or electric hammer. One type can be installed by hand hammer. — Omark Industries, Inc., Drill Anchor Div.

511 Facts on Pipe Tools

Colorfully illustrated, pocket size 16 page catalog gives finger tip facts and describes all "Ridgid Work-Saver" pipe tools and gives product features and capacities. Includes wrenches, pipe cutters, tubing cutters, flaring tools, threaders, vises, power drives and stands, pipe and bolt threading machines and accessories. — The Ridge Tool Co.

512 Pipe Cutting and Beveling Machines

Six page catalog shows H. & M. pipe cutting and beveling machines, accessory equipment. Seven models cut, bevel pipe from $1\frac{1}{2}$ to 36 in. Shape cutter for cutting saddles, tees, ells, other irregular shapes. Out-of-round attachment cuts irregular pipe. Accessories include flexible shaft, pipe dollies, motorized units, boxes, hooks, clamps. — H. & M. Pipe Beveling Machine Co.

513 Pipe Tools

Twelve page catalog 1057-A illustrates Reed tools. Chain and yoke bench or tripod vises; tubing cutters; 1, 3 and 4 wheel pipe cutters; hinged cutters (for cast iron or steel pipe to 12 in.), solid die and adjustable threaders, self-feeding reamers, chain wrenches from 10 to 60 in. length. — Reed Mfg. Co.

514 Powder-Actuated Fastening Methods

Powder-actuated tool catalog, form B-141, 12 pages, answers questions about powder-actuated fastening in maintenance and construction. Complete information on tools, fasteners. Charts, graphs, and pictures facilitate understanding of technical phases, principles behind powder-actuated fastening. Powder-actuated fastening tools, fasteners, powder charges, hammer-in fastening tools and fasteners illustrated. — Ramset Fastening System.

515 Powder-Actuated Tools

Bulletin explains operation of Omark "Drive-It" tools and drivepins which provide rugged, permanent fastening to concrete or steel. Different models are described and illustrated. Sample applications are shown. Material on special accessories is included. Folder is well-illustrated, easy to read, direct and to the point. — Omark Industries, Inc., Fastening Div.

516 Powder-Driven Fastener Handbook

Powder-driven fastener handbook B-124 for architects and engineers details various technical phases of powder-actuated fastening. Pictures, charts and graphs illustrate principles and applications. Includes glossary of terms. — Ramset Fastening System.

517 Rotary Pipe Cutters

Literature describes Reed portable, manual cutters for steel or cast iron from 12 to 24 in. diameter. Four wheel, separable frame design requires less digging in the ditch, speeds clean cuts even on out-of-round pipe, according to the literature. — Reed Mfg. Co.

518 Stud Drivers and Accessories

Ten page catalog 58-517-S of Remington stud drivers and accessories describes powder-actuated tools, special guards, adaptive kits, power loads, studs, other equipment. Cross-reference charts show (by manufacturers' names and model numbers) how equipment functions on wide range of structural materials like outlet boxes, roofing and siding sections, etc. — Remington Arms Co., Inc.

519 Stud Driving System

Nelson powder-actuated fastening system described. Shows tools, drivestuds, power loads. Clearly defines how tool can simplify heating applications . . . shows correct headed drivestud, threaded drivestud or eye pin to use for hundreds of applications. — Gregory Industries, Inc.

520 Timesaving Tools

New 8 page fully illustrated bulletin E-240 describes more than 60 Greenlee timesaving tools, including lightweight hydraulic benders; hydraulic pipe pushers; portable, high pressure hydraulic power pumps; and complete line of power bits, pipe bits, auger bits, chisels and allied tools. — Greenlee Tool Co.

521 Woodworking Tools

New 6 page bulletin H-308 describes over 75 tools, including power bits, solid-center auger bits, expansive bits, augers and car bits, chisels, gouges, screwdrivers, push drills, and the Greenlee "Zip Bit." A brief description and complete size range for all tools are listed in bulletin. — Greenlee Tool Co.

Unitary Air Conditioning

522 Air Conditioner Certification

Booklet entitled "A New Assurance" describes unitary air conditioner certification program of the ARI. — Air-Conditioning & Refrigeration Institute.

523 Air Conditioning

Booklet LL-352 describes and has illustrations of the various Chrysler Airtemp water and air cooled conditioning units, packaged and split systems, heat pumps, electrostatic air purifier and room air conditioners. — Airtemp Div., Chrysler Corp.

524 Air Conditioning

All data pertinent to easy, accurate selection of vertical style, fan coil, year 'round hydronic air conditioning units available to the system designer through American-Standard type 20 "Remotaire" application manual. Includes complete design specifications; detailed dimensions; selection procedure, tabulated and charted capacities; motor and electrical characteristics; control descriptions. — American Radiator and Standard Sanitary Corp., Plumbing and Heating Div.

525 Air Conditioning Units

Four page bulletin RS2E describes air or water cooled air conditioning units, and packaged liquid chillers. Includes photos and specifications. — Curtis Mfg. Co.

526 Air Conditioning Units

A description of variety of arrangements, coil selections, accessories of model AH air conditioning units. Includes units ranging in capacity from 650 to 35,000 cfm, available with class II construction for static pressures up to 6½ in. Dimensions are given as well as modifications by shape and size of filter box. — Recold Corp.

527 Air Cooled Split System Equipment

Complete line of air cooled split system equipment ranging in capacities from 3 to 20 tons. — United States Air Conditioning Corp.

528 Air Handling Equipment

Sectional constructed air handling units for cooling, heating, ventilating, humidifying, dehumidifying and filtering, either single or multiple zone. — United States Air Conditioning Corp.

529 Air Units

One page bulletin describes Rempe air units for any temperature from 38 to 300 deg; all humidities; reheat with steam, water or electrical elements as required. Available in sizes 2, 3, 5, 7½ and 15 tons. Units can be furnished with copper tube, steel hot galvanized, or stainless steel cooling coils. — Rempe Co.

530 Central Station Air Conditioning

Central station draw-through "Multitherm" air conditioning units, in both horizontal and vertical arrangements, are fully covered in 40 page catalog 1309. Capacity tables, selection guides, coil data, dimensions, and sample problems are included. Sprayed coil as well as general purpose "Multitherms" are described. — Clarage Fan Co.

531 Central Station Air Conditioning Cabinets

New bulletin AC-121 gives complete data on Buffalo model G central station air conditioning cabinets. Type PC for horizontal floor or ceiling installation, type UPC for vertical operation, type PCW spray coil for horizontal operation, type VPCW spray coil for vertical operation. Details on performance data. — Buffalo Forge Co.

532 Central Station Air Conditioning Units

New revised bulletin 30 describes Marlo central station air conditioning units for heating, humidifying, cooling, dehumidifying, filtering, circulating. Ceiling or floor mounting types, horizontal or vertical air flow. Includes illustrations, construction features, performance data, charts, diagrams, etc. — Marlo Coil Co.

533 Dual Purpose Air Handling Unit

Twenty-four page bulletin DD-5 describes large central station equipment for dual duct or multi-zone air conditioning systems complete with fans, filters, cooling and heating coils, automatic dampers, sprays, pumps, etc. — Buensod-Stacey, Inc.

534 Fan Coil Air Conditioning Units

New series of "Weathermaker" units, in conjunction with a boiler-chiller team, is designed to provide selective air conditioning for each room, office, or unit in commercial, residential, or industrial buildings. Available in three styles and four sizes to 560 cfm. Descriptive 8 page catalog includes features and technical data. — Carrier Corp.

535 Large Capacity Air Conditioning Units

Whether used singly or as part of a multiple unit air conditioning system, these larger capacity (7½ to 15 tons) Carrier "Weathermakers" are designed to meet the varied requirements of business and industry. Fully described in the 8 page catalog are features and ratings, as well as diagrams and dimensions. — Carrier Corp.

536 Large Remote Condensing Units

Bulletin 7017 provides engineering data for LR-CU large remote air cooled condensers. Diagrams and capacity curves fully cover the Dunham-Bush line with additional rating specifications, construction details, and installation data. A table of national summer weather conditions is included. — Dunham-Bush, Inc.

The classification of "Unitary Air Conditioning" starts on the preceding page and includes 29 items describing catalogs, bulletins and booklets that are available on request. To obtain your copies of the ones that you are interested in, you are invited to make use of the reply cards on pages 2-29 and 2-31.

537 Multi-Zone Air Conditioner Units

Catalog discusses construction features, operational aspects of Recold multi-zone air conditioner. Possible arrangements as affected by motor location and coil connection described. Data on general specifications, nominal ratings provided. Units have capacities from 1640 to 35,000 cfm, are available with class II construction for static pressures up to 6½ in. — Recold Corp.

538 Package Air Conditioners

Self contained package air conditioners, air and water cooled, attic stowaway residential units. — Welbilt Air Conditioning & Heating Corp.

539 Packaged Water Chillers

Vilter "Uni-Chiller" packaged water chillers for refrigerant 22 in sizes from 25 through 125 nominal tons are described. All major components, including VMC reciprocating compressor, flooded or direct expansion chiller, condenser and control package, illustrated and described in eight page bulletin. — The Vilter Mfg. Co.

540 Registers and Grilles

"Fabrikated" solid bar grilles and grille cores for cabinet units and metal partitions are described in catalog 58. — The Independent Register Co.

541 Remote Air Conditioning Units

Eight page bulletin 230 gives complete dimensional and capacity information about new line of remote horizontal air conditioning units. Units can be supplied for both heating and cooling using steam, water, and direct expansion. Cooling capacities range from 2 to 15 tons. — Bohn Aluminum & Brass Corp., Danville Div.

542 Remote Room Conditioners

Individual Acme room conditioners for multi-room buildings, vertical and horizontal units with or without cabinets, are covered in detail in 4 page brochure 381A. Specifications, capacity data, and dimensions for the 16 models in the line are given. — Acme Industries, Inc.

543 Roof Mounted Air Conditioning

Bulletin describes "Atmos-Pak" year 'round roof mounted prefabricated air conditioning systems. — Air Conditioning, Inc.

544 Roof Top Heating and Cooling Unit

Mammoth's YR series is completely enclosed weatherproofed "Compact-Aire" roof top heating, cooling unit for outdoor installation. Described in bulletin YR-460. Available in four sizes with Btu outputs, gas or oil, from 150,000 to 500,000. Coil space, blower capacities to handle any standard cooling equipment from 3 to 20 tons. — The Mammoth Furnace Co.

545 Self-Contained Air Conditioners

Self-contained air conditioners complete with built-in evaporative condensers, water cooled condensers or for use with air cooled condensers, ranging in size from 3 to 60 tons. — United States Air Conditioning Corp.

546 Unitary Air Conditioners

More than 175 units listed on "Galaxy" reference chart. Included are 136 air conditioning products, 49 gas and oil fired furnaces. Divided into three parts (unitary air conditioners, heat pumps, furnaces) chart gives series designation and specifications. This chart is designed for reference in determining the right unit for a particular job. — Typhoon Air Conditioning Div., Hupp Corp.

547 Unitary Air Conditioners

Full line wall chart SA-60-1 illustrating and giving specifications for unitary air conditioners, furnaces, heat pumps, compressors and condensing units, packaged water chillers, air handling units, room type air distributing units, condensers, electronic air cleaners, and other products. — Westinghouse Electric Corp., Air Conditioning Div.

548 Year-Round Air Conditioner

Quality, year-round Webster "Newport" air conditioner unit, self-contained cooling cycle, is described. Heating is connected to conventional hot water, steam or electric heating system. Individual control of heating and cooling in every unit—select comfort with flip of a switch. Ideally suited to any multi-room application. — Warren Webster & Co., Inc.

549 Year 'Round Room Air Conditioners

Bulletin 6014A details Dunham-Bush CR products for the unit system of air conditioning. Heating and cooling installations are pictured. Features, parts, model details, rating and dimensional tables, installation and piping accessories, wiring diagrams, unit selection data, capacity curves and pressure drops are included. — Dunham-Bush, Inc.

550 Zone Control Cabinets

"Year 'Round Comfort with One Central Unit," four page bulletin AC-2500, describes the model G zone control cabinets. Types PCB and VPCB, for heating, ventilating, and air conditioning where one unit must provide air for several zones. Construction and operation are covered for manual and automatic control. — Buffalo Forge Co.

Unit Heaters & Unit Ventilators

551 Cabinet Unit Heaters

McQuay type CH cabinet unit heaters designed for economical, dependable forced air space heating when steam or hot water is used as thermal medium. Possible applications are schools, churches, hospitals, offices, stores and shops. Bulletin 351 covers general design features, unit arrangements, capacity ratings, curves, performance data, specifications, other information. — McQuay, Inc.

552 Direct Fired Heaters

Four page bulletin 502 describes Arkos direct fired heaters available in eight floor models to 550,000 Btu and eight suspended models to 550,000 Btu. Features of both types are described and illustrated and dependability and fuel economy are discussed. Dimensions and specifications are included. — Arkos Mfg. Co.

553 Gas Fired Heaters, Duct Furnaces

General catalog SA-5900 describes the complete line of Reznor gas-fired unit heaters, duct furnaces, heavy duty heaters, blower fans and the new Reznor motorized flue exhauster. Dimensions, performance data and application suggestions are included. — Reznor Mfg. Co.

554 Gas Fired Unit Heaters

Roberts-Gordon catalog gives details on extensive line of oil and gas fired cast iron boilers, oil and gas fired furnaces, central air conditioning units, conversion and industrial gas burners and gas fired unit heaters. Sizes and designs for domestic heating, industrial, institutional and commercial applications. — Roberts-Gordon Appliance Corp.

555 Gas Fired Unit Heaters

Bulletin GHC-3B describes line of Wing gas-fired, overhead unit heaters with revolving and fixed discharge outlets. Ceiling suspended, downward discharge. Complete self-contained units offer uniform heat distribution. Catalog gives construction features and engineering data. — L. J. Wing Mfg. Co. Div. of Aero Supply Mfg. Co. Inc.

556 Heating and Ventilating Cabinets

Bulletin UH-130 gives complete data on Buffalo model G heating and ventilating cabinets. These units are engineered for heating and ventilating or ventilating only. Sectionalized cabinet includes fan section, coil and base section. Horizontal or vertical operation. Filter boxes, mixing boxes, dampers, outlet elbows available. Aerofin coils used. — Buffalo Forge Co.

557 Heating and Ventilating Units

American-Standard heating and ventilating units are made in both draw-through and blow-through arrangements in 11 sizes for central station requirements 600 cfm to 66,000 cfm. Steam or hot water heating coils, described in bulletin 9727, available with choice of five coil types. Flexibility is achieved through sectional design. — American-Standard Industrial Div.

558 Infra Red Heaters

Bulletin pictures and describes the use of overhead gas fired "Panelbloc" infra red heaters as applied to commercial and industrial structures. Tables of weights and dimensions are given as well as technical data on controls and accessories. There are illustrations of various types of structures in which the equipment has been installed. — The Bettcher Mfg. Corp.

559 Revolving Unit Heaters

Bulletin HR-6A describes Wing downflow unit heaters with revolving or fixed discharges. Heaters are available in wide range of sizes for mounting heights from 8 to 60 ft and over. Capacities up to 1,209,000 Btu per hr. For steam or hot water. — L. J. Wing Mfg. Co. Div. of Aero Supply Mfg. Co. Inc.

560 School Heating, Ventilating, Cooling

Bulletin covers, in detail, the application of Lennox "Comfort Curtain" equipment for heating, ventilating and cooling classrooms. Specific sections cover air distribution, two-classroom systems, in-the-room systems, central warm air, central hot water, central steam, electric heating, heat pump, air conditioning and "Comfort Curtain" controls. Bulletin is illustrated. — Lennox Industries Inc.

561 Space Heaters

Catalog 2659 illustrates and fully describes how to efficiently space heat in buildings with high ceilings. Sixteen pages include technical data, mounting heights, spread circle diameters, unit capacities of 30 sizes, specifications, and dimensional drawings. Complete charts, tables and graphs also included. — Young Radiator Co.

562 Steam Heat Transfer Surface

Catalog 956 describes "Grid" cast iron steam heat transfer surface unit heaters, blast heaters, and radiators, and illustrates one-piece construction. Included are air distribution charts, heating capacities, conversion tables, and specifications. This four-section catalog with tab index is well illustrated. — D. J. Murray Mfg. Co.

563 Steam and Hot Water Unit Heaters

Catalog contains descriptive, dimension and performance data on propeller type unit heaters for steam and hot water systems. — Modine Mfg. Co.

564 Unit Heaters

Eight page bulletin UH858 on Grinnell unit heaters presents information, illustrations of gas fired and steam or hot water unit heaters for variety of applications. Sound rating recommendations for typical environments, guides for unit selection, installation, location are provided with data on two-speed motor operation, velocity nozzles, vertical delivery. — Grinnell Co., Inc.

565 Unit Heaters

Wilson unit heaters, available in six models in capacities 60,000 to 717,000 Btu, are described in bulletin 60. Unit heater is completely dependable in service where corrosive atmospheres are encountered. Uses directional finned radiation. — Wilson Engineering Corp.

566 Ventilators

Brochure discusses positive ventilation regardless of wind direction. The Triangle "Aero-Foil" is ideally suited to use as flue cap due to no-down-draft design. Available in aluminum, stainless steel, and copper in addition to standard galvanized. — Triangle Engineering Co.

YOUR COMMENTS ARE REQUESTED

Your comments on this trade literature supplement to Heating, Piping & Air Conditioning will be most welcome, and we invite you to write us. We'd like very much to know if you find this service useful, and how we can improve upon it.

For example, are the descriptions of the catalogs, bulletins and other data arranged conveniently? Are they so classified as to be of the most value to you? Did you fail to find something you were looking for? Are the items themselves complete enough? Or too complete?

Address your remarks to Trade Literature Supplement, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill. And thanks for your help.

Valves, Fittings & Flanges

567 Automatic Regulating Valves

Bulletin 954 describes automatic regulating valves for controlling the flow, pressure or temperature of hot water and steam in pipes or related items. — Klipfel Valves, Inc.

568 Bar Stock Valves

Bar stock valves are described in 16 page bulletin DH-766B. — R-P&C Valve Div., American Chain & Cable Co., Inc.

569 Branch Connection Fittings

Bulletin TF-1 introduces "W-S Fishmouth," new way to make branch connections. Fully machined to shape from schedule 40 pipe, fits perfectly with run pipe. Sizes 2 in. and up. "W-S TeeLet," sizes $\frac{1}{8}$ to $1\frac{1}{2}$ in., designed to give low cost connections for high pressure, small branch pipe applications. — "W-S" Fittings Works, H. K. Porter Co., Inc., Forge and Fittings Div.

570 Branch Pipe Construction

Four page bulletin S-1A describes "Sweepolet" forged, integrally reinforced, insert butt welding pipe fittings, specially designed for applications on high yield pipe in the oil and gas transmission industries. Design features, how to install these fittings are discussed and dimensions are tabulated. — Bonney Forge & Tool Works.

571 Bronze Gate Valves

Two page circular 574 illustrates and lists features of many types of bronze gate valves — screwed, solder or flange ends; $\frac{1}{4}$ to 3 in. sizes; rated at 125 lb SP, 200 lb WOG and 150 lb SP, 300 lb WOG. — The Lunkenheimer Co.

572 Bronze Globe Valves

Four page circular 602-2 describes the two pressure classes of LQ600 bronze globe valves with patented "Brinalloy" seats and discs. It details features and sizes of Fig. LQ600-150 valve, rated at 150 lb SP, 30 lb WOG; and Fig. LQ600-200 valve, rated at 200 lb SP, 550 F, 400 lb WOG. — The Lunkenheimer Co.

573 Bronze and Iron Body Valves

Circular V-6 is a condensed catalog of Fairbanks valves used in heating, piping and air conditioning systems. Includes bronze and iron body gate, globe and check valves with pressure ratings from 125 to 300 lb. Each valve illustrated and sizes available and basic descriptions provided. Threadless valves of bronze (gates, globes and checks) included. — The Fairbanks Co.

574 Bronze Valves

Thirty-six page catalog VC-3 is devoted to low pressure and pressure rated valves, solder end and threaded, gate, globe, boiler drains, stop and stop & waste. A chart shows flow characteristics, and valve installation pointers are given. — Nibco Inc.

575 Bronze Valves

Five condensed catalog sheets showing full line of O-B bronze gate, globe, angle and check valves. Complete description of O-B's low and standard pressure and plumbing and heating valves is included. — Ohio Brass Co.

576 Check Valve Units

Eight page bulletin describing basic-check units which, when combined with standard pipe fittings of almost any type, form complete check valves for wide variety of services. Illustrations show use with different pipe fittings, tanks and pressure vessels. Included are construction details, ratings, and a table of sizes and dimensions. — Durabla Mfg. Co.

577 Check Valves

Technical bulletin CH-100-A describes a multi-duty check valve engineered for the heat pump featuring teflon seats. Will not chatter even under very low flow. Instant-acting for extremes of temperatures and pressures. Hermetically sealed. Ten million cycles at 350 psi show no appreciable wear. Range is $\frac{1}{2}$ through 20 tons. — Chatleff Valve & Mfg. Co.

578 Check Valves

The full line of CPV silent, non-slam check valves is described in bulletin 600. Details are given on operation of these spring actuated valves, which close silently before reverse flow occurs. Sizes from $\frac{1}{2}$ to 24 in. Also described are relief valves, air check valves, swing joints and pump valves. — Combination Pump Valve Co.

579 Check Valves

Two page circular 588 illustrates and lists, with specifications, many types of check valves — bronze, iron and steel — for boiler feed lines; for air, water and steam lines; and for controlling chemical and gaseous fluids. — The Lunkenheimer Co.

580 Check Valves

Detailed data on "Williams-Hager" Silent check valves for control of water hammer and surge pressures. Center guided and globe types. Sizes for 1 to 24 in. lines. — Williams Gauge Co., Inc.

581 Control of Water Hammer

Detailed data on water hammer, with conclusions on how it may be controlled in piping systems. — Williams Gauge Co., Inc.

582 Copper Pipe and Tube Fittings

Fittings and accessories for copper pipe and tubing, solder, flanges, and flared, are the subject of 92 page catalog I. There are sections on wrought copper fittings, cast solder fittings, cast drainage fittings, flared tube fittings, flanged fittings, heating specialties, and accessories. — Nibco Inc.

583 Copper Tube Fittings and Valves

"Anaconda" publication C-12 gives complete listing with illustrations of the wide range of wrought copper and cast brass solder type fittings for use with copper tube piping installations. — The American Brass Co.

584 Corrosion Resistant Fittings

Twenty-four page bulletin on "Speedline" corrosion resistant fittings includes engineering data, details on complete line of stainless steel "long tangent" pipe fittings, ½ through 4 in., for light-wall schedules 5 and 10 process piping. Information on butt welding, socket joining and use of unique "Speedline" insert flange. — Speedline Fittings Div., Horace T. Potts Co.

585 Corrosion Resistant Welding Fittings

Catalog describes dimensions and analyses and gives corrosion tables for corrosion resistant welding fittings. — C. A. Roberts Co.

586 Diaphragm Valves

Grinnell-Saunders diaphragm valve catalog S-V-60, 48 pages, describes and illustrates their exceptional fitness for handling materials which are corrosive, viscous, fibrous, solids in suspension, liquids, gases and semi-fluids, under pressure or vacuum. Exclusive construction features, wide choice of body, linings and diaphragm materials; long life, simple maintenance. — Grinnell Co., Inc.

587 Eccentric Valves

Eight page bulletin 110 describes the eccentric principle under which DeZurik valves are designed. It also lists the dimensions, wide variety of materials, etc., of the manually-operated DeZurik valves, used on air conditioning installations. — DeZurik Corp.

588 Engineering Catalog

This book offers descriptions, properties, chemical resistances, detailed specifications and installation data covering polyvinyl chloride pipe, fittings, valves and sheet stock. — The Colonial Plastics Mfg. Co., Van Dorn Iron Works.

589 Forged Stainless, Alloy and Carbon Steel Fittings

Application of "W-S" high pressure (2000, 3000, 6000 lb) pipe fittings and eight types of unions described in bulletin A3-S1. Data on screw end and socket welding, ⅛ to 4 in., stainless, alloy and carbon steel fittings includes dimensions and weights. Thirty-two pages (includes eight pages of engineering specifications, data.) — "W-S" Fittings Works, H. K. Porter Co., Inc., Forge and Fittings Div.

590 Forged Steel Fittings

Data sheet on threaded and socket welding elbows and tees available in forged steel and a wide range of alloys. Dimensions are given for 2000, 3000 and 6000 lb threaded fittings, and 2000, 3000, 4000 and 6000 lb socket welding fittings. — Bonney Forge & Tool Works.

591 Forged Steel Gate Valves

Forged steel gate valves are described in bulletin. — R-P&C Valve Div., American Chain & Cable Co., Inc.

592 Forged Steel Unions

Specifications of screw end and socket welding, ⅛ to 3 in., unions for high pressure, high temperature applications given in bulletin U-2. Dimensions and weights of forged steel unions, tongue and groove and O-ring flange unions, also orifice, tab orifice, clamp ring, insulated, 2-lug nut and "4-Star" lug nut unions. — "W-S" Fittings Works, H. K. Porter Co., Inc., Forge and Fittings Div.

593 Gate Valves

Four page supplement H to catalog VC-3 covers "Husky" gate valves with buna-N conical type gate. Will throttle. Construction features are described and illustrated and dimensions are tabulated. Ratings and uses are shown. — Nibco Inc.

594 Light Weight Carbon Steel Fittings

Four-way savings from use of light weight carbon steel piping are outlined. Dimensions given for complete line of uniform wall, light weight welding fittings in sizes ½ through 24 in. for use with schedule 10 or API 5L pipe. Exclusive 125 lb light weight taper face welding neck flanges also covered. — Tube Turns Div. of Chemetron Corp.

595 Lubricated Plug Valves

Catalog 400 contains complete information on the full line of ACF semi-steel lubricated plug valves, sizes ½ through 30 in., pressure ratings 175 through 800 lb WOG. Details on accessories, special valves and lubricants also included. — W-K-M Div. of ACF Industries, Inc.

596 Overhead Valve Operators

Bulletin shows the 10 sizes of Babbitt adjustable sprocket rims and guides for operating overhead valves from the floor, as well as the range of valve handwheel diameters they will fit. Also shown are the list prices of the rims and guides as well as the chain which fits them. — Babbitt Steam Specialty Co.

597 Packless Valves

Robertshaw packless valves in many types and sizes are described in catalog F. Multi-ply seamless metal bellows assures longer life, greater flexibility. Brass, steel, stainless steel materials. Seating materials selected for best performance on required service. For high vacuum service. Also pressures to 500 lb at temperature of 1000 F. — Fulton Sylphon Div., Robertshaw-Fulton Controls Co.

598 Pipe Line Strainers

Manual 957 describes the complete line of Zurn LPD "low pressure drop" pipe line strainers. Covers in detail duplex, "Sinlex" and "Y" type strainers plus a section on special purpose pipe line strainers. Includes photographs, engineering drawings, dimensions, and pressure drop charts. Time saving information on proper ordering is also included. — Zurn Industries, Inc., Fluid Control Div.

599 Plug Valves for Air Conditioning

How ACF lubricated plug valves can save maintenance, operating and installation costs in air conditioning systems is described in bulletin AP 1059. Dimensional data and other information on these valves is also included. — W-K-M Div. of ACF Industries, Inc.

600 Polyethylene Pipe and Fittings

Four page brochure on "Polyfusion" illustrates by pictures and step by step operation the simple method used by American Vulcathene Div., Nalge Co., Inc., in joining "Vulcathene" polyethylene pipe and fittings to give permanent leakproof joints for acid waste and drainage systems. — American Vulcathene Div.

601 Radiator Valves and Fittings

Latest catalog (bulletin 225) of Sarco radiator valves for hot water, steam, and radiant heating — plus balancing fittings and access boxes. Includes data and roughing-in dimensions. — Sarco Co., Inc., and Sarcotherm Controls, Inc.

602 Refrigerant Valves and Controls

Condensed catalog 20 has descriptive and capacity data on thermostatic expansion valves, refrigerant distributors, solenoid valves, suction line regulators, flooded evaporator controls, reversing valves, and miscellaneous products. — Alco Valve Co.

An index by manufacturers whose catalogs, bulletins and other literature are described in this supplement to Heating, Piping & Air Conditioning appears on the back cover (page 2-60.) It shows the item numbers for each of the companies.

Page numbers for the general classifications into which the items are grouped are given in the index on the front cover.

603 Regulators

Steam capacity and flow data and formulas enable calculation of fluid flow rates in pipes at given velocities. Steam velocity chart and recommended capacities for Spence temperature and pressure regulators are given in illustrated condensed catalog 350. — Spence Engineering Co., Inc.

604 Renewable Seat Ring Bronze Gate Valves

Circular V-126 describes Fairbanks patented 200 lb bronze gate valves in which the nickel alloy seat rings can be replaced in from 7 to 10 minutes without the need of ever removing the valve body from the line. Simplicity of replacement illustrated step by step. Valves available in rising and non-rising stem construction. — The Fairbanks Co.

605 Reversing Valves

Design of reversing valves features a full seating system. Few moving parts. Dense brass movement and teflon seating give extreme durability and life. Dual tube construction and full seating design protects user against efficiency loss from heat exchange and leakage. Range is 1 through 20 tons. — Chatleff Valve & Mfg. Co.

606 Safety Devices and Controls

Sixteen page condensed catalog illustrates and describes complete line of heating and plumbing safety devices and controls. Describes operation and function of each product, giving necessary operating data, dimensions, weights, ranges, and settings. — Watts Regulator Co.

607 Seamless and Welded Welding Fittings

Twelve page bulletin 60-C describes new line of seamless butt welding fittings, now offered in addition to extensive line of welded type fittings. Manufacturing procedures, size ranges and types of available fittings — both stock and special — are listed and illustrated, together with a description of metallurgical and dimensional controls. — Midwest Piping Co., Inc.

608 Seamless Welding Fittings and Flanges

A guide to the selection of B&W seamless welding fittings and flanges in carbon, alloy and stainless steels is given in bulletin FB-502. Includes illustrations of the standard types of fittings and flanges, and a list of sizes and weights available. Also lists the applicable ASTM specifications. — The Babcock & Wilcox Co., Tubular Products Div., Welding Fittings Dept.

609 Semi-Steel Valves

Complete catalog V-203 rev. 1 of semi-steel "Rockwell-Nordstrom" lubricated plug valves, straightway, Multiport, locking device, wrenches and lubricant. Complete specifications included. — Rockwell Mfg. Co.

610 Service Cocks, Meter and Air Cocks

Complete information on the Rockwell lubricated service cock line is given in catalog V-605. — Rockwell Mfg. Co.

611 Steel Pipe Couplings

New bulletin gives sizes, lengths, threads, weights and carton contents of Wheatland merchant, half and API line pipe couplings plus other information, with complete specifications on steel pipe, including standard, extra strong, double extra strong and structural pipe. Illustrated, and printed in two colors on durable stock. — Wheatland Steel Products Co.

612 Thermostatic Expansion Valves

Combined catalog and technical bulletin lists Sporlan's complete line of thermostatic expansion valves for refrigerants 12, 22, 500 (Carrene-7), and 717 (ammonia). In addition to photos and dimensional drawings, bulletin 10-10 contains capacity tables, information on thermostatic charges and other valuable data on expansion valves, their selection, installation and service. — Sporlan Valve Co.

613 UPVC Pipe Fittings, Flanges and Valves

Design data and specifications for a complete line of pipe fittings, flanges and valves made of UPVC (unplasticized polyvinyl chloride), "Penton" (chlorinated polyether) and other thermoplastics. Sizes through 8 in., threaded and socket type. UPVC drainage fittings also covered. — Tube Turns Plastics, Inc.

614 Valve Comparison Chart

Valve comparison chart permits the user to determine the figure numbers of Fairbanks bronze and iron body valves that by similarities of design, construction, and pressure rating may be used in the same application as valves of other manufacturers. Comparison tables are arranged alphabetically by manufacturer with valves listed numerically. — The Fairbanks Co.

615 Valves

An 84 page catalog illustrates and describes many types of bronze and steel valves in globe, gate, angle, check, flow control, etc., designs. Sizes are available from 1/4 to 6 in. — Manning, Maxwell & Moore, Inc.

616 Valves

Twenty-four page booklet briefly covers the line of Powell "Quality" valves — gates, checks, globes, angles, "Y"s and others. Sizes as well as pressure and temperature ratings are listed. Valves are available in bronze, iron, steel and alloys to control the flow of water, oil, gas, air, high and low pressure steam, and corrosive fluids. — The Wm. Powell Co.

617 Valves

Bronze, iron and cast steel valves are described in 16 page catalog 10-A. — R-P&C Valve Div., American Chain & Cable Co., Inc.

618 Valves for Industry

Listing of O-B bronze gate, globe, angle and check valves by figure number, size, type of disc, type of pipe ends, and pressure ratings. — Ohio Brass Co.

619 Valves, Traps and Piping

Technical sales bulletin 12 contains technical information on the installation and enclosure of automatic and manual control valves, traps, and piping arrangement for 3 in. thin Shaw "PanelVectors." — Shaw-Perkins Mfg. Co.

620 Water Diverting Valve

Technical bulletin V-101 describes "Vectrole" V-58 electric water diverting valve offering the following features: Dense brass construction. Silent, non-liming moving parts. Balanced resistance to flow in either position. Range from 0 to 10 gpm. Simple, compact, field serviceable. On-off operation for automatic summer-winter convector control. — Chatleff Valve & Mfg. Co.

621 Welding Fittings

Forty-four page catalog W-5 contains complete information on carbon steel, stainless and alloy welding fittings — "Weldolets," "Thredolets," "Sockolets," "Elbolets," and "Brazolets." Applications to various piping services are discussed and illustrated, and sizes and dimensions are tabulated. Installation procedures, when and where to use these fittings are discussed. — Bonney Forge & Tool Works.

622 Welding Fittings and Flanges

New 176 page catalog 60 covers seamless and welded type butt welding fittings and forged steel flanges. Detailed dimensional and engineering data given on fittings and flanges in carbon steel, wrought iron and alloy steels. Fifty-four page technical section features useful information for piping designers. Copiously illustrated. — Midwest Piping Co., Inc.

623 Y Strainers

Semi-steel body, self cleaning Riggio Y strainers, available with stainless steel screens with either 0.020 or 0.045 in. perforations are described in a bulletin. These strainers are for steam, air, oil, or water service. The sizes of strainers available are ½ to 2 in. — Frank D. Riggio Co., Inc.

624 Zone Heating Valve

Four page color brochure describes operation of "Zonvalve" thermostatically controlled zone heating valve. Cutaway views show mechanical features, cartoons illustrate ease of installation and operation. Layouts show typical installations on radiators, convectors and supply lines. Photos of all models and accessories, wiring diagram and dimensions are included. — Heat-Timer Corp.

Warm Air & Direct Fired Heating

625 Direct Fired Heaters

Six page bulletin 501A describes Arkos direct fired heaters for all capacities, all fuels, all applications and all mountings. Features are described and illustrated, details of engineering are emphasized, and a table of ratings is included. Various applications and mountings are described and sketched. — Arkos Mfg. Co.

626 Direct Fired Heaters

Four page bulletin 502 describes Arkos direct fired heaters available in eight floor mounting models to 550,000 Btu and eight suspended models to 550,000 Btu. Features of both types are described and illustrated and dependability and fuel economy are discussed. Dimensions and specifications are included. — Arkos Mfg. Co.

627 Direct Fired Heaters

Six page data bulletin 802-R on National "Champion" direct fired heaters for oil, gas, or combination fuels for space heating, tempering, make up air, and drying. Features — including "Teardrop" design stainless steel combustion chamber — described and illustrated, and ratings are given. Btu outputs from 400,000 to 3,000,000 Btu. — National Heater Co.

628 Direct Fired Space Heaters

Booklet C-658 provides drawings of typical installation arrangements of "Commercial-Aire" direct fired heaters in the 300,000 to 2,000,000 Btu output range. This reference booklet provides the user a wide variety of proven design applications for commercial and industrial forced air systems. — The Mammoth Furnace Co.

629 Fiber Duct

A four page illustrative brochure on "Sonoairduct" fiber duct. The duct is designed particularly for slab floor perimeter heating or combination heating and cooling systems. Information regarding air friction loss, thermo-conductivity and general installation instructions are included in the brochure. — Sonoco Products Co.

630 Furnaces

Publication LL 354-355 lists various types of furnaces and their specifications and performances. Various applications for installations of Chrysler Airtemp furnaces, gas and oil fired, are described and the special features are listed in detail. — Airtemp Div., Chrysler Corp.

631 Furnaces

Roberts-Gordon catalog gives details on extensive line of oil and gas fired cast iron boilers, oil and gas fired furnaces, central air conditioning units, conversion and industrial gas burners and gas fired unit heaters. Includes sizes and designs for domestic, institutional, commercial, industrial heating applications. — Roberts-Gordon Appliance Corp.

632 Furnaces

More than 175 units are listed on "Galaxy" reference chart. Included are 136 air conditioning products and 49 gas and oil fired furnaces. Divided into three parts (unitary air conditioners, heat pumps and furnaces) chart gives series designation and specifications. Designed for easy reference in determining the right choice of a unit. — Typhoon Air Conditioning Div., Hupp Corp.

633 Furnaces

Full line wall chart SA-60-1 illustrating and giving specifications for unitary air conditioners, furnaces, heat pumps, compressors and condensing units, packaged water chillers, air handling units, room type air distributing units, condensers, electronic air cleaners, etc. — Westinghouse Electric Corp., Air Conditioning Div.

634 Gas Fired Heaters, Duct Furnaces

General catalog SA-5900 describes the complete line of Reznor gas fired unit heaters, duct furnaces, heavy duty heaters, blower fans and the new Reznor motorized flue exhauster. Dimensions, performance data and application suggestions are included. — Reznor Mfg. Co.

635 Heating

Equipment for residential and commercial heating, forced air and boiler operation, gas or oil fired, steam or hot water is described in a comprehensive bulletin. — Welbilt Air Conditioning & Heating Corp.

636 Horizontal Suspended Furnaces

Bulletin 59S-1 offers dimensional and engineering data for "Compacto" horizontal suspended furnaces available in oil or gas with outputs from 185,000 to 450,000 Btu. Six different designs are presented, including four which utilize oversize blowers, bypasses or a combination of both, for combination heating-cooling systems, or air make-up applications. — The Mammoth Furnace Co.

637 Industrial Direct Fired Heaters

All information necessary for applying industrial direct fired heaters (with heat exchangers) is included in 64 page text. Not advertising. This manual covers heat loss calculation, air distribution (nozzle and duct), single and multiple installations, door heating, make-up air, process heating, fuel piping and consumption, controls. Conversion tables are included. — Lennox Industries Inc.

638 Perimeter Diffusers

Four page circular, form 101, on U. S. perimter base diffusers, and perimeter base intakes. Also covers diffuser sidewall and base registers, and floor registers and diffusers. Features, dimensions, prices given. — United States Register Co.

639 Unit Heaters and Horizontal Furnaces

Specification sheet information on complete Mueller "Climatrol" unit heater line ranging from 25,000 to 250,000 Btu input. The gas fired unit heaters are shipped assembled, pre-wired and test fired. Horizontal oil and gas fired (with type 550 power burner) are available in sizes from 110,000 to 350,000 Btu input. — Mueller Climatrol Div. of Worthington Corp.

640 Warm Air Heating

Four page, four color folder "The Quality Tells" (form JS 110P), describes customer benefits derived from equipment features pointed up in cutaway of forced warm air heating unit. — Janitrol Heating & Air Conditioning, A Div. of Midland-Ross Corp.

641 Warm Air Heating Equipment

"Winter Chaser" warm air heating equipment is described in bulletin 382. — Campbell Heating Co.

Water Treatment & Corrosion Control

642 Air Conditioning Water Treatment

Booklet F-9736R1 describes "10 minutes a day" do-it-yourself procedure to eliminate scale, slime, algae and to reduce downtime in air conditioning systems with Oakite "Airefiner" No. 52. — Oakite Products, Inc.

643 Boiler Water Sampler

Leaflet describes boiler water sampler suitable for boiler blowdowns to 900 psi and 750 F. Body is 4½ in. OD by 16 in. long. Coil contains 30 ft of copper tube. This sampler is available with stainless steel cooling coil when required. — Rempe Co.

644 Controlling Scale, Slime, Corrosion

Service report B-7556 tells about Oakite "Airefiner" No. 54, the single package answer to (1) keeping calcium and magnesium salts (scale) from depositing on equipment, (2) inhibiting growth of algae and slime forming organisms, and (3) controlling water pH. to prevent corrosion in recirculating water systems. — Oakite Products, Inc.

645 Proportioning Pumps

Eagan chemical feed pumps for water treatment are described in bulletin. — Walter H. Eagan Co., Inc.

646 PVC Block Stock

Full description of "Boltaron" PVC 6200 block stock in following sizes: 2, 2½, 3 and 4 in. and 12 in. x 12 in. blocks. — Bolta Products Div., The General Tire & Rubber Co.

647 Slime and Corrosion Control

Service report B-6686 tells how Oakite 55M effectively controls slime and corrosion in air washing systems in tobacco, textile and other plants, highly susceptible to corrosion and algae formations. — Oakite Products, Inc.

Welding Equipment

648 Backing Rings

Four page bulletin 58-2 on Robvon backing rings for welding pipe, which save time in fit up and handling, maintain consistent root penetration, and provide radiographic quality welds. Various types are described and are illustrated and specifications are given in this bulletin. — Robvon Backing Ring Co.

649 Insulation Applications

Folder explains how Omark-Graham stud welding system utilizes "stored energy" and portable welding machines for fast method of installing insulation to ductwork, tanks, boilers, breechings, corrugated metal, other metal surfaces. Application takes three steps: (1) pointed "Insulpins" stud welded to metal surface, (2) insulation pressed on pins and (3) insulation secured with metal clips. — Omark Industries, Inc., Stud Welding Div.

650 Pin Welder

Bulletin describes Nelson "LG" pin welder, and a reliable method of securing insulation to galvanized ducts, furnaces, boilers and vessels. Outlines advantages of trigger-operated welding gun, new "Nelsonized" pins, and advanced power source. — Gregory Industries, Inc.

651 Welding Electrodes

A complete description of the more than 80 electrodes in A. O. Smith's welding line. Also included is the new AWS and NEMA color coding on electrodes. — A. O. Smith Corp.

652 Welding Machines

A complete catalog of more than 39 different welding machines manufactured by A. O. Smith. Included are a-c, d-c, a-c—d-c, gas drives in all ampere ranges. — A. O. Smith Corp.

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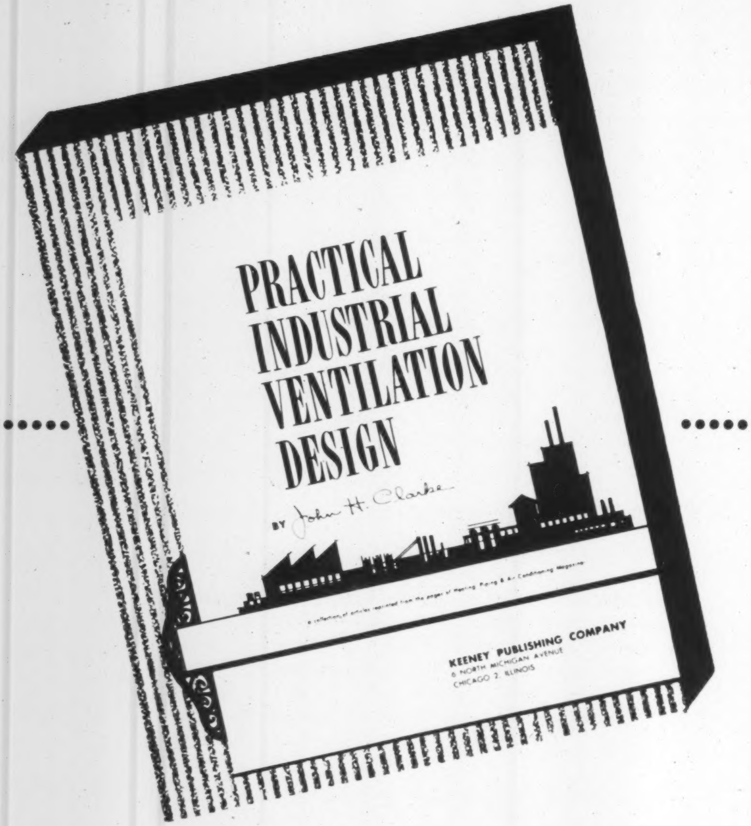
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